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OPERATING INSTRUCTIONS

MARK II
RECORDER
ALL MODELS

MANUAL NUMBER
RD-802521-00

BRUSH INSTRUMENTS DIVISION
37TH AND PERKINS / CLEVELAND, OHIO 44114 / AREA CODE 216-361-3315
CLEVITE
CORPORATION

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BRUSH
MARK II RECORDER
ALL MODELS

Figure 1.1 Brush Mark II Recorder

1.1 INTRODUCTION

The Brush Mark II Recorder provides an immediately visible, two channel analog chart recording over the frequency range of D.C. to 100 cps. Two channels of coded, event, or time data may be directly written on a common time base. The Recorder includes both oscillograph and amplifiers in one integral unit and may be operated from an A.C., 60 cps., 105-125/210-230 volt power source. Ink-writing or electric-writing models are available.

The recorder is designed for minimum operator adjustment with three simple controls per channel. (The electric-writing models provide a single trace density control for both channels.) Push buttons permit instant selection of chart speeds. The Mark II Recorder also features easy front loading or changing of the chart paper, unitized components, extreme stability, and high sensitivity; a 10 millivolt input signal produces a pen deflection of one chart line (mm).

Information in this manual applies to all Brush Recorders of the Mark II series. The model numbers included in this series are as follows:

60 Cycle Model	50 Cycle Model
RD 2521-20	RD 2521-25
RD 2521-10	*
RD 2521-00	RD 2521-05
RD 2522-20	RD 2522-25
RD 2522-00	*

* No 50 cycle model produced.

Except for power source and transmission assembly, the models listed in the right column are identical to those in the left column.

NOTE: Model RD 2521-20 Recorders with serial No. 896 or subsequent and Model RD 2522-20 Recorders with serial No. 827 or subsequent feature a restyled case. These recorders are electrically identical to earlier units of the same model number. Please check Model and Serial number of recorder when ordering parts.

1.2 SPECIFICATIONS

Sensitivity	All Models	10 millivolts per chart line (mm). Full scale of deflection from chart center ± 200 millivolts.
Sensitivity Steps	All Models	.01, .02, .05, .1, .2, .5, 1, 2, 5, and 10 volts per chart line (mm). Maximum attenuator error 1% with balanced input.
Measurement Range		
Single-ended Input (5 Megohm)	All Models	.010 volt to 400 volts.
Balanced Input (10 Megohm)	All Models	.010 volt to 400 volts, side to side, allowable voltage off-ground at any attenuator step is 1000 x volts per chart line switch setting up to 500 volts off-ground.
Common Mode Rejection	All Models	Better than 1000 to 1, attenuator set in .01 volt per chart line position.
Zero Line Stability	RD 2521-20 RD 2521-10	Less than 1/10 chart line (mm) per hour. Total drift over eight hour period not more than 1/4 chart line (mm).
	RD 2521-00 RD 2522-00	Less than 1/2 chart line (mm) per hour. Total drift over eight hour period not more than one chart line (mm).
	RD 2522-20	Less than 1/4 chart line (mm) per hour. Total drift over eight hour period not more than 1/2 chart line (mm).
Noise	All Models	Not noticeable on chart with shorted input.
Frequency Response	All Models	The recorder peak-to-peak amplitude of a constant voltage sine wave will be within ± 1 chart line (mm) of a nominal 10 lines from D.C. to 100 cps.
Maximum Amplitude	All Models	40 lines (mm) peak-to-peak, D.C. to 40 cps. 20 lines (mm) peak-to-peak, D.C. to 70 cps. 10 lines (mm) peak-to-peak, D.C. to 100 cps.
Pen Bias	All Models	Permits positioning of pen on chart, ± 20 chart lines (mm). Effective for either single-ended or balanced input.

SPECIFICATIONS (Cont)

Trace Linearity	RD 2521-20 RD 2521-10 RD 2521-00	D.C. within 1% full chart width. A.C. within 2% full chart width, any frequency within limits of maximum amplitude
	RD 2522-20 RD 2522-00	D.C. within 2% full chart width. A.C. within 3% full chart width, any frequency within limits of maximum amplitude
Trace Width	RD 2521-20 RD 2521-10 RD 2521-00	0.015 inch with Model RA 2821-31 pen.
	RD 2522-20 RD 2522-00	0.005 inch with Model RA 2822-31 styli.
Writing Method	RD 2521-20 RD 2521-10 RD 2521-00	Ink
	RD 2522-20 RD 2522-00	Electric Stylus
Number of Analog Recording Channels	All Models	Two
Number of Event Channels	All Models	Two, actuated by external switch (external switch optional).
	RD 2521-20 RD 2521-10 RD 2522-20	Additional front panel switch provided to actuate left event marker.
Channel Width	All Models	40 mm (40 divisions).
Chart Speeds	RD 2521-20 RD 2521-10 RD 2521-00 RD 2522-20	1, 5, 25, and 125 mm per second. (Slow speed option available)
	RD 2522-00	.4, 2, 10, and 50 mm per second.
Chart Supply	RD 2521-20 RD 2521-10 RD 2521-00	300 feet long x 3.718 inch wide.
	RD 2522-20 RD 2522-00	150 feet.
Chart Speed Regulation	All Models	Synchronous motor, direct drive.

SPECIFICATIONS (Cont)

Operating Temperature Range, Ambient	All Models	0°C to 55°C.
Power Requirements	RD 2521-20 RD 2522-20	105-125/210-230 volts, 60 cps, 135 watts at 115 volts.
	RD 2521-10 RD 2521-00 RD 2522-00	105-125 volts, 60 cps, 135 watts at 115 volts.
	RD 2521-25 RD 2522-25	105-125/210-230 volts, 50 cps, 135 watts at 115 volts.
	RD 2521-05	105-125 volts, 50 cps, 135 watts at 115 volts.
Input Terminals		
Front (signal)	All Models	Binding Posts
Rear (event marker)	All Models	Binding Posts
Dimensions	All Models	12-5/8 inch wide x 12 inch high x 13-1/2 deep.
Net Weight	RD 2522-20	39 pounds
	RD 2521-20	38 pounds
	RD 2522-00	34 pounds
	RD 2521-10	32 pounds
	RD 2521-00	32 pounds
Shipping Weight	RD 2522-20	45 pounds
	RD 2521-20	44 pounds
	RD 2521-10 RD 2521-00 RD 2522-00	38 pounds
Ventilation	RD 2521-20 RD 2521-10 RD 2522-20	Fan ventilated, through rear panel

1.3 SUPPLIES AND ACCESSORIES

The supplies and accessories listed in Table 1.1 will provide continuing peak performance of the Brush Mark II Recorder.

TABLE 1.1 Supplies and Accessories

Brush Part Number	Recorder Model No.	Description
RA 2921-32	RD 2521-20 RD 2521-10 RD 2521-00	Chart Paper, Ink, 2-Channel, 300 feet long.
RA 2922-22	RD 2522-20 RD 2522-00	Chart Paper, 2-Channel, 150 feet long.
227418-910	All Models	Gram Gage Assembly
RA 2761-02	RD 2521-20 RD 2521-10 RD 2521-00	Ink, Red, 202, in Mark II Reservoir
RA 2821-31	RD 2521-20 RD 2521-10 RD 2521-00	Pens, Ink (4)
125160-501	RD 2521-20 RD 2521-10 RD 2521-00	Syringe Assembly
RA 2822-31	RD 2522-00 RD 2522-20	Electric Styli (4) Electric Styli (Event Channels - 2)
341081-915	RD 2522-20	Electric Styli (2)
126717	All Models	Pen Mounting Tool

1.4 OUTLINE DIMENSIONALS

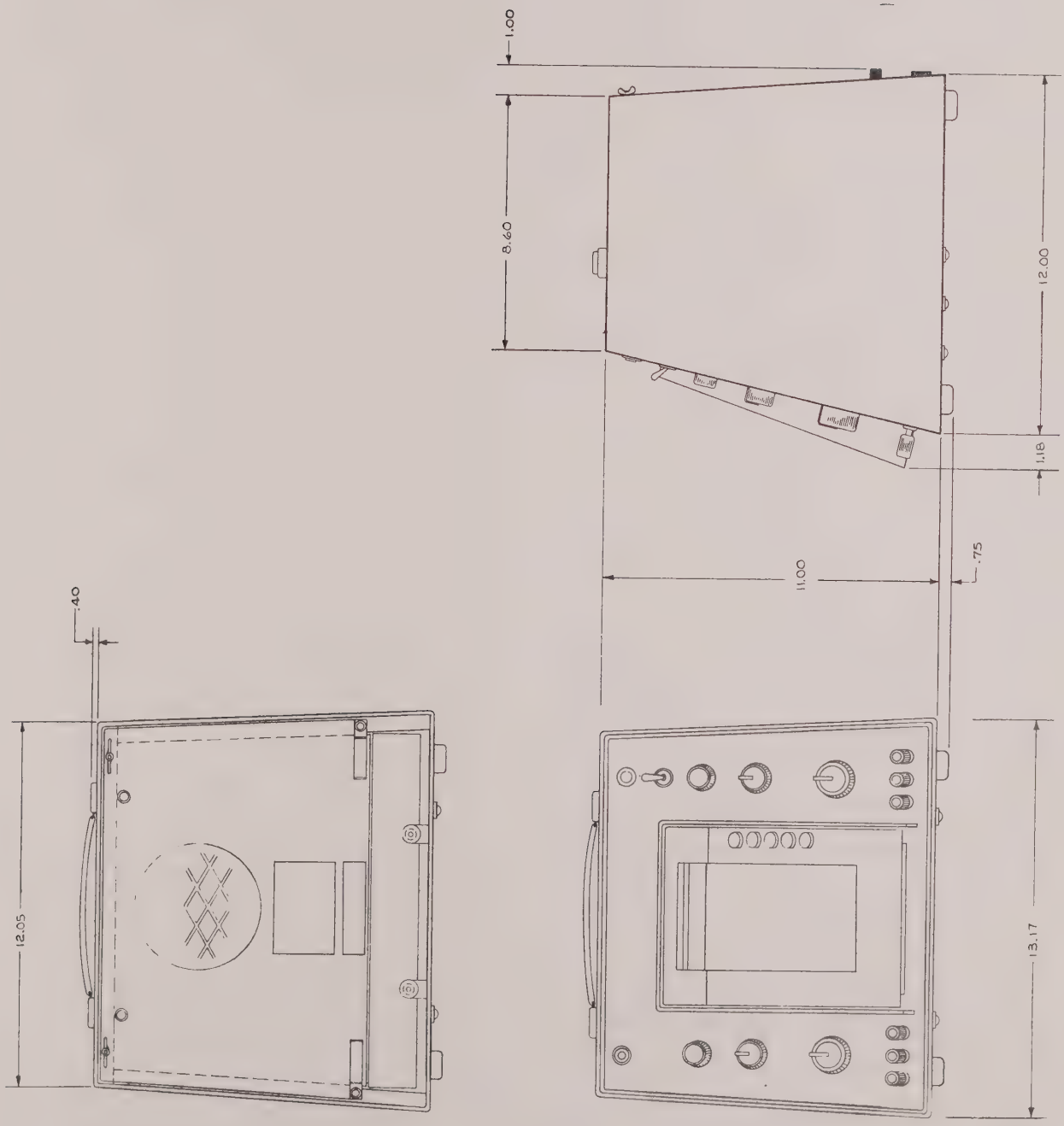


Figure 1.2 Outline Dimensions
Model RD 2521-20 (Restyled Case)

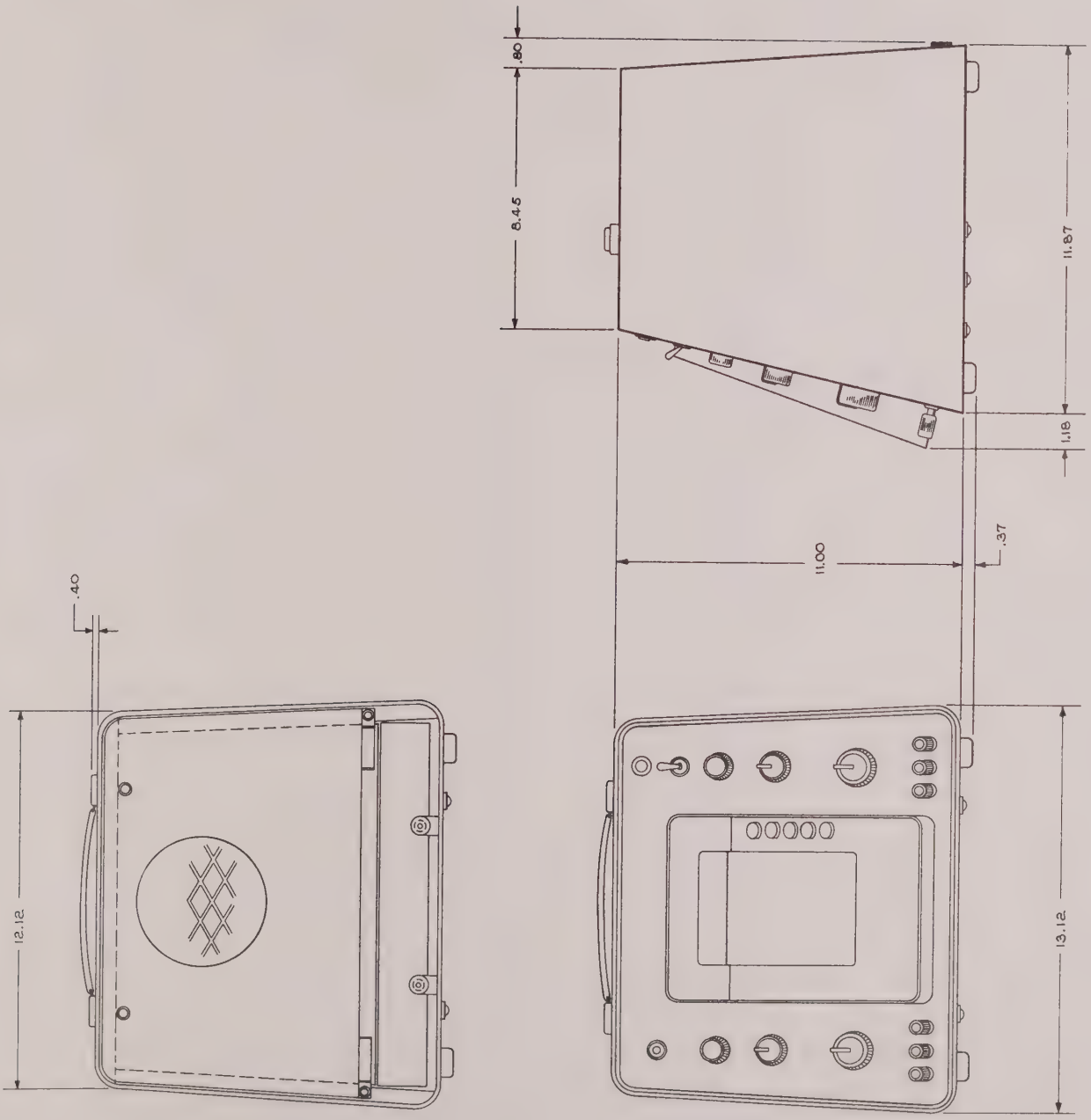


Figure 1.3 Outline Dimensions
Model RD 2521-10

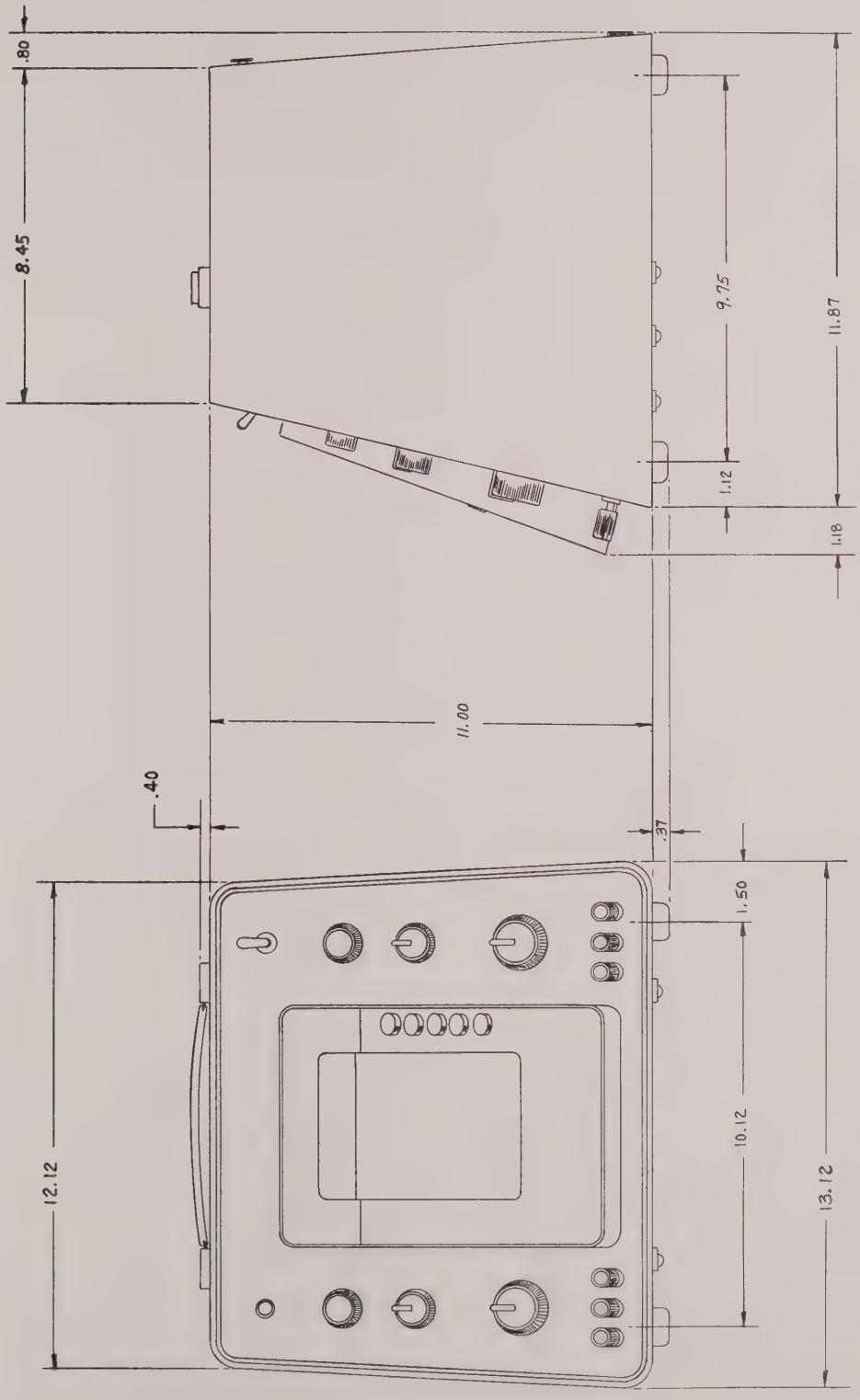


Figure 1.4 Outline Dimensions
Model RD 2521-00

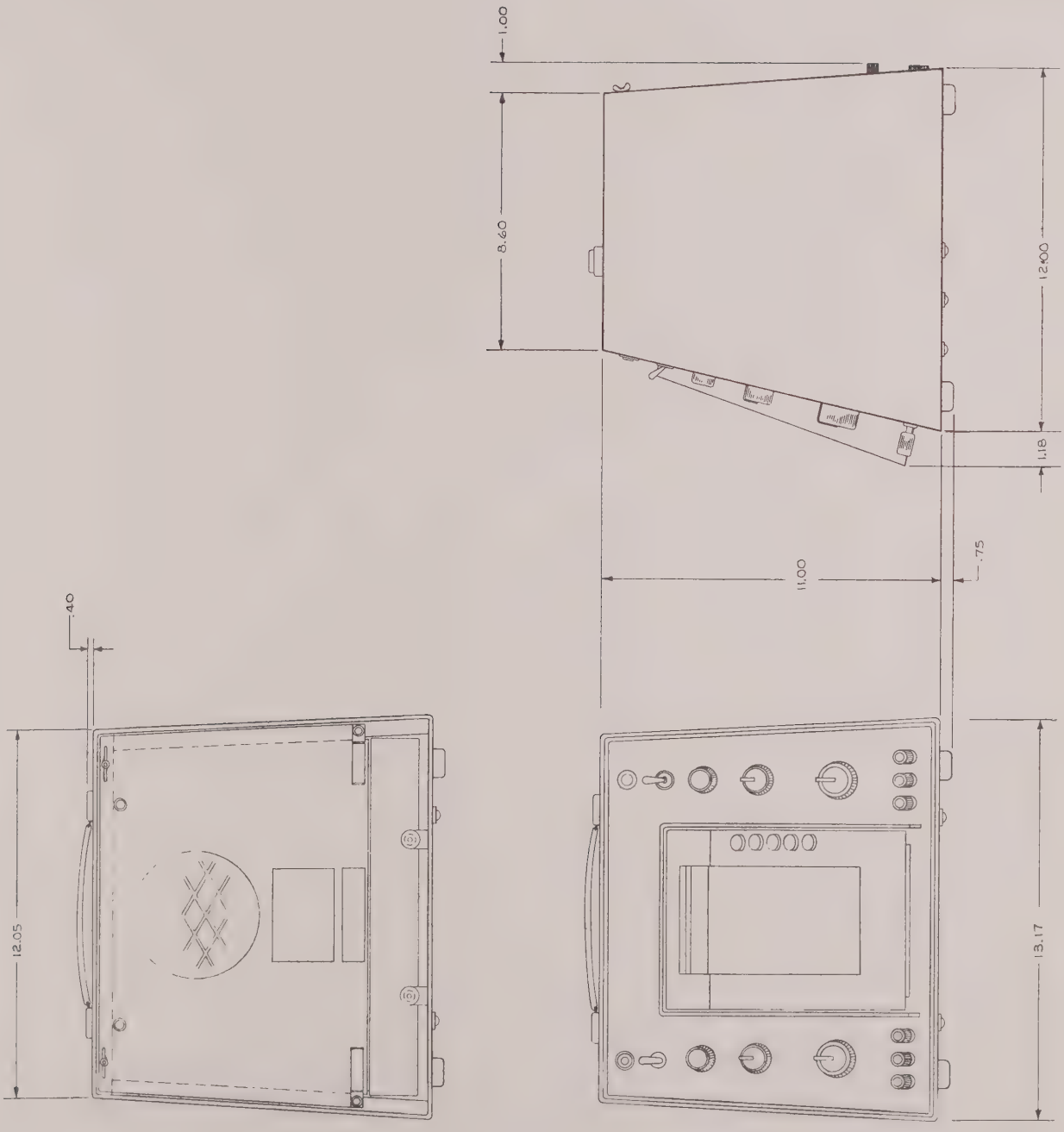


Figure 1.5 Outline Dimensions
Model RD 2522-20 (Restyled Case)

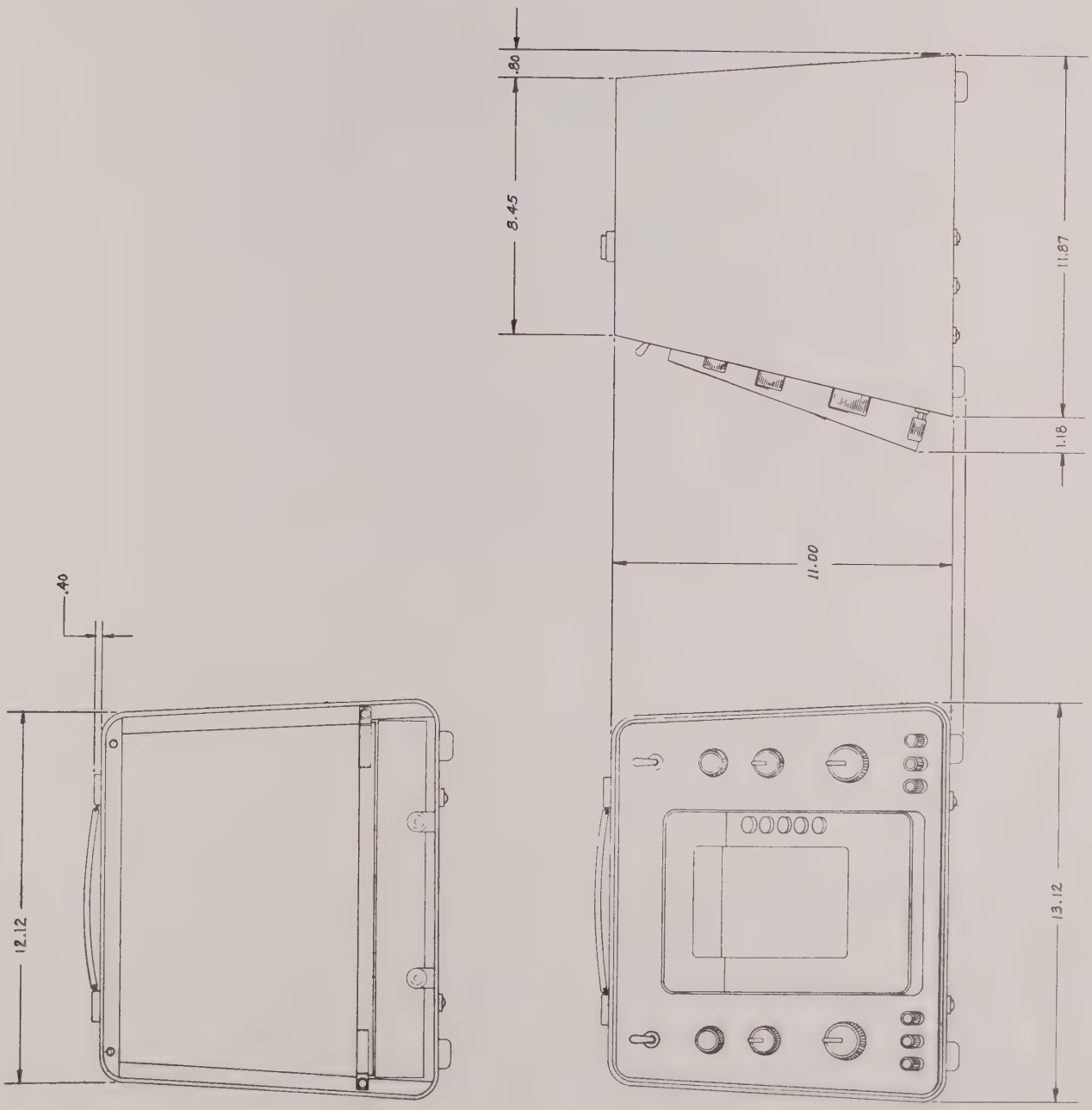


Figure 1.6 Outline Dimensions
Model RD 2522-00

1.5 CONTROL DESCRIPTION

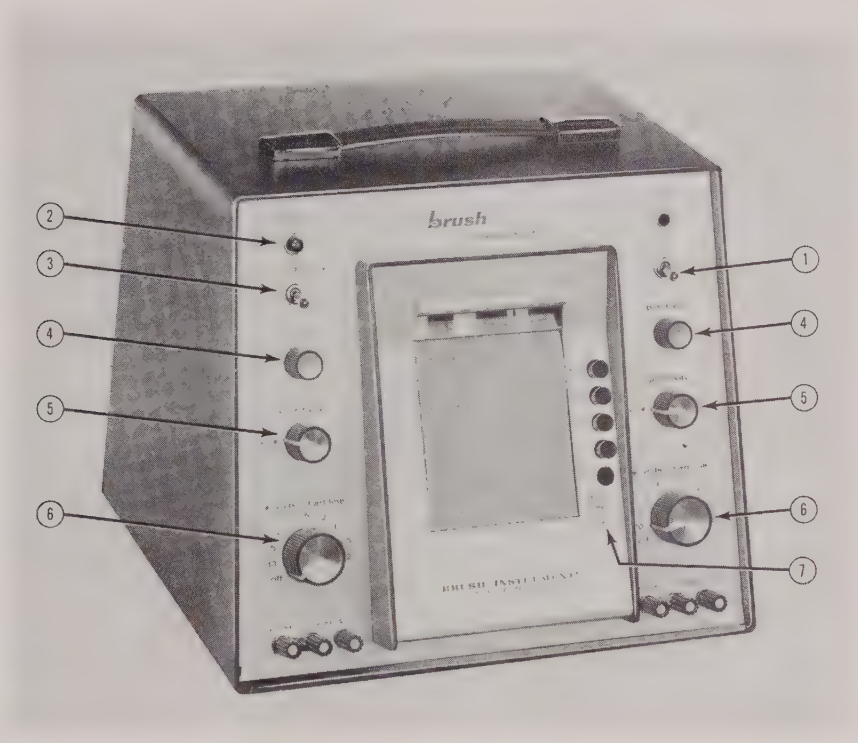


Figure 1.7 Front Panel Controls

1.5.1 FRONT PANEL CONTROLS

1.	Power On	All Models	On-off power switch, toggle type, with indicator light. (No indicator - RD 2522-00)
2.	Mark Event	RD 2521-20 RD 2521-10 RD 2522-20	Momentary contact push button operates left-hand event marker.
3.	Trace Density	RD 2522-20 RD 2522-10	Toggle type switch, increases or decreases trace density.
4.	Pen Bias	All Models	Potentiometer Control. Stylus centering or displacement.
5.	Sensitivity	All Models	Potentiometer-switch combination. Increases, decreases, or removes sensitivity control.
6.	Volt/Chart Line	All Models	Multi-position, rotary switch, attenuates input signal.
7.	Chart Speed	All Models	Chart speed selection in millimeters per second.

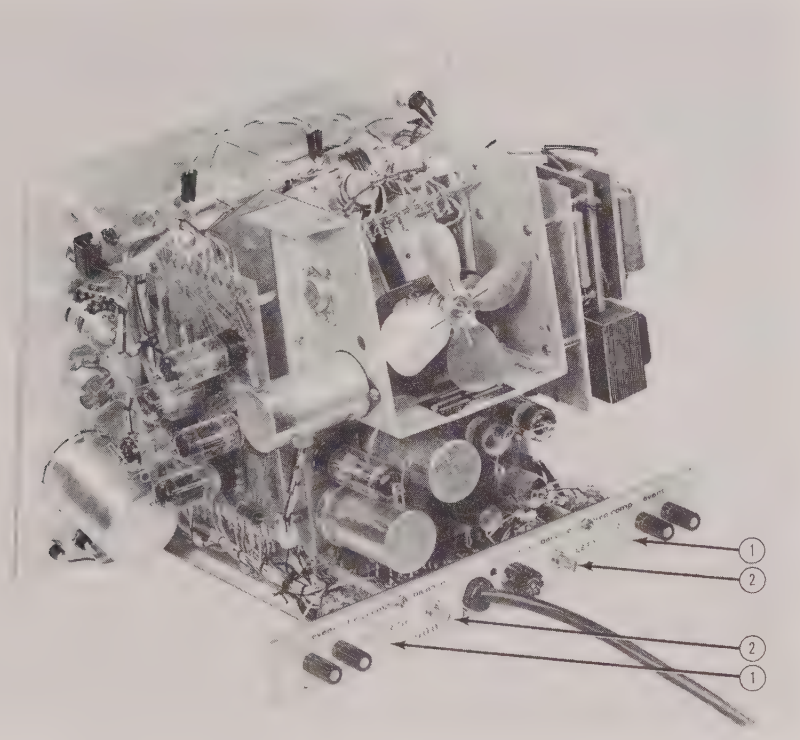


Figure 1.8 Rear Panel Controls

1.5.2 REAR PANEL CONTROLS

1.	Frequency Compensation	All Models	Adjusts frequency compensation of unit.
2.	Balance	All Models	Adjusts balance of unit when balance procedures are followed.

2.1 GENERAL

The Brush Mark II Recorder is compact, portable, and requires no special installation considerations.

3.1 GENERAL

The step-by-step procedure for placing the Mark II Recorder into operation is as follows:

3.2 PRELIMINARY OPERATION

1. CONNECT POWER

   Connect power cord to an appropriate power source; 60 cps, 105-125 volts.

   NOTE: Models RD 2521-20 and RD 2522-20 may be connected to 60 cps, 210 to 230 volts with appropriate internal connections (see schematic).

2. STABILIZE INSTRUMENT

   Place POWER switch to ON, depress CHART SPEED OFF button and allow 15 minutes warm-up time prior to signal application.

3.3 CHART PAPER LOADING PROCEDURE

Perform the following steps when loading or changing chart paper supply.

NOTE: Electric writing models incorporate a safety interlock to remove styli voltage when the front door or bezel is opened.

1. OPEN BEZEL

   Pull bezel out and downward as far as possible, then pull writing table out and upward as far as possible. (Ref. Fig. 3.1)

2. REMOVE SUPPLY SHAFT

   Lift paper tension arm and remove paper supply shaft.

3. INSTALL PAPER SUPPLY

   Insert supply shaft in paper supply roll, lift tension arm, then position shaft in slots in writing table side plates. (Ref. Fig. 3.2)

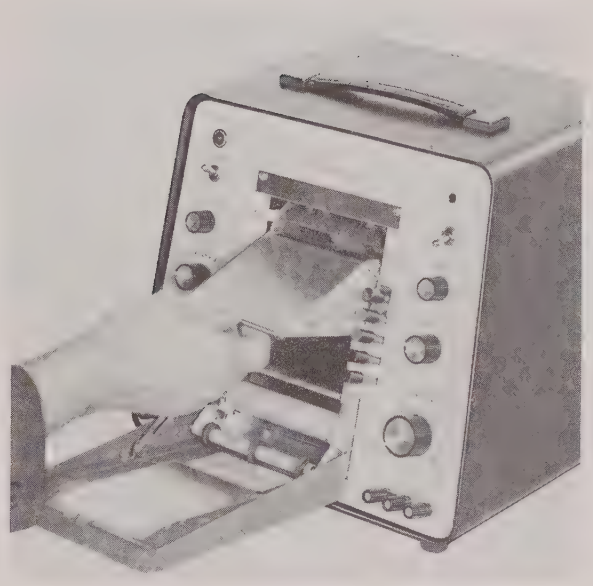


Figure 3.1 Door Open

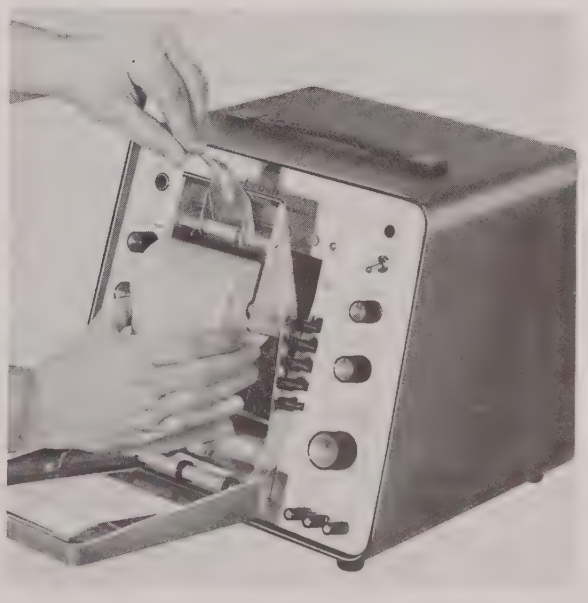


Figure 3.2 Paper Supply Installed

4. REPOSITION TENSION ARM

Unroll approximately 4 inches of paper downward and reposition tension arm on paper supply. Take up any slack behind the arm.

5. THREAD PAPER

Feed chart paper up over table, then pull paper to end of writing table.

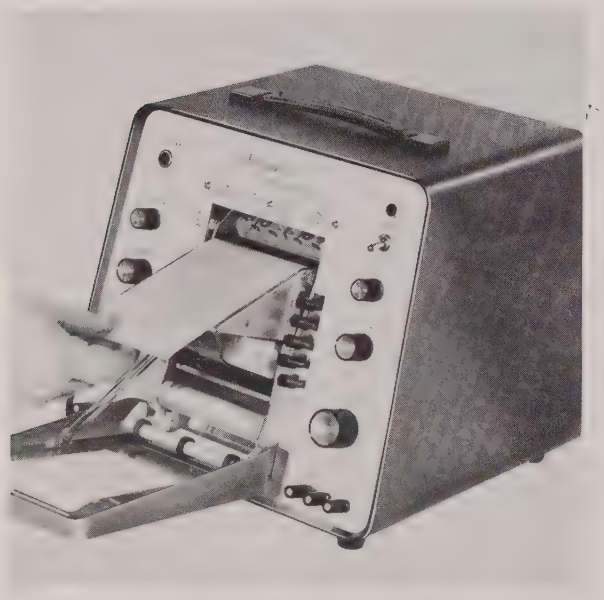


Figure 3.3 Paper Threading

6. RETURN TO OPERATING POSITION

Return writing table to operating position. Feed chart paper between drive and tension rollers and close bezel.

7. ALIGN PAPER

Operate recorder a few seconds at 25 mm/second to align paper on writing table (10 mm/second for Model RD 2522-00).

3.4 STYLI OR PEN TRACE CHECK

The Mark II Recorder has been inspected and ad-

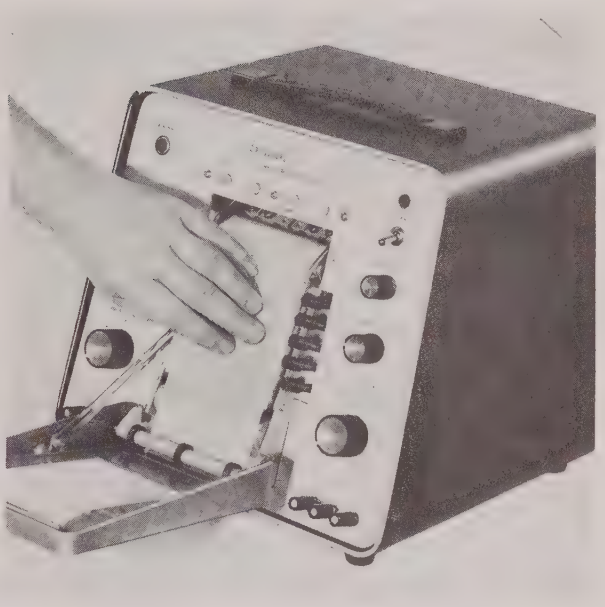


Figure 3.4 Feed Paper Between Rollers

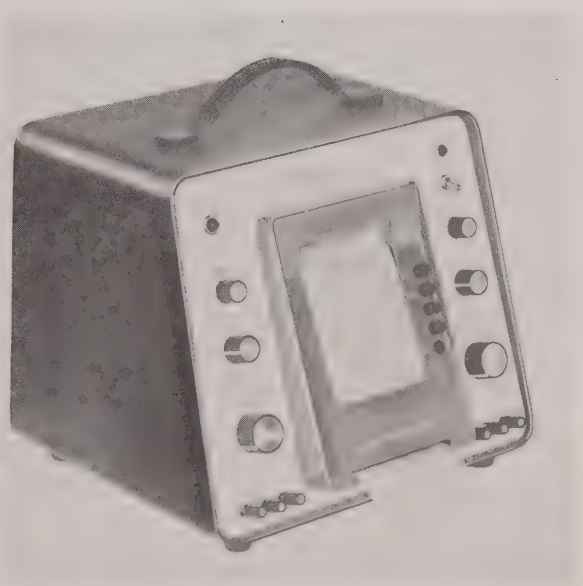


Figure 3.5 Ready for Operation

justed prior to shipment. To insure proper trace, operate the instrument a few seconds at each chart speed and check trace. If trace is unsatisfactory, refer to appropriate maintenance section for corrective procedure.

3.5 BALANCING

The Mark II Recorder has been calibrated and frequency compensated prior to shipment from the factory. However, the following balancing procedure should be observed before beginning to record.

1. POSITION SWITCHES

   Set VOLT/CHART LINE controls to OFF position. Turn SENSITIVITY control to extreme clockwise position.

2. ALLOW INSTRUMENT TO STABILIZE

   Verify that power has been on for a minimum of 15 minutes before proceeding.

3. CENTER PEN OR STYLUS

   Using PEN BIAS control, center pen or stylus on chart.

4. ADJUST FOR NO DEFLECTION

   Turn BALANCE control, on rear of instrument, to extreme clockwise position. Rotate SENSITIVITY control alternately left then right and at the same time, turn BALANCE control counterclockwise until no pen or stylus deflection is noted.

5. RE-CENTER STYLUS

   Using PEN BIAS control, re-center pen or stylus then turn SENSITIVITY control to x 1 position.

   NOTE: Calibration and frequency compensation procedures are described in "Maintenance Section V" should either of these adjustments be necessary.

3.6 SIGNAL APPLICATION

Verify that preliminary operations have been completed, then proceed as follows:

1. POSITION SWITCHES

   Place VOLT/CHART LINE switches to OFF.

2. POSITION PEN OR STYLUS

   Press slowest chart speed button, then use PEN BIAS control to bring pen or stylus to desired position on chart paper. Press CHART SPEED OFF button.

3. APPLY SIGNAL

   Connect signal to INPUT 1 and 2 terminals. For single ended input, use ground strap to connect INPUT 1 and GROUND terminals. For balanced or double-ended input, remove ground strap.

4. POSITION SENSITIVITY CONTROL

   Turn SENSITIVITY control counterclockwise until switch is actuated in x1 position. Press desired CHART SPEED button and set VOLTS/CHART LINE switch in desired position. When SENSITIVITY control is in the x1 position, the recorded signal is equal to product of number of chart lines (mm) pen deflection times VOLTS/CHART LINE switch setting. If additional sensitivity values are desired or if external calibration is used, turn SENSITIVITY control clockwise from x1 position until preferred pen deflection is obtained.

3.7. EVENT MARKERS

The Event Markers are actuated by external switches.

NOTE: Models RD 2521-20, RD 2521-10, and RD 2522-20 are equipped with a pushbutton panel switch which parallels external circuit connections for left event marker.

Power for the event markers is supplied internally from a 24 volt D.C. supply and signal connection is made through EVENT terminals on the rear of the recorder.

4.1. GENERAL

The Brush Mark II Recorder consists of two analog channels, their associated D.C. amplifiers, two event channels, and a common power supply section. The input circuit of each amplifier channel provides selection of single-ended or balanced input signals and attenuation of signal voltages. The D.C. amplifier section in each channel amplifies input signals to the level required for driving an oscillograph penmotor. The output circuit within each D.C. amplifier applies amplified signals to the penmotor, applies negative feedback to stabilize overall gain in the amplifier section, and provides adjustment of amplifier frequency response to produce optimum recorder response.

The penmotor converts electrical signals to mechanical pen motion, which is recorded on chart paper by a closed ink system, or by an electric writing system. A pushbutton operated four speed transmission couples torque from the synchronous motor to the chart drive shaft.

BLOCK DIAGRAM - MARK II

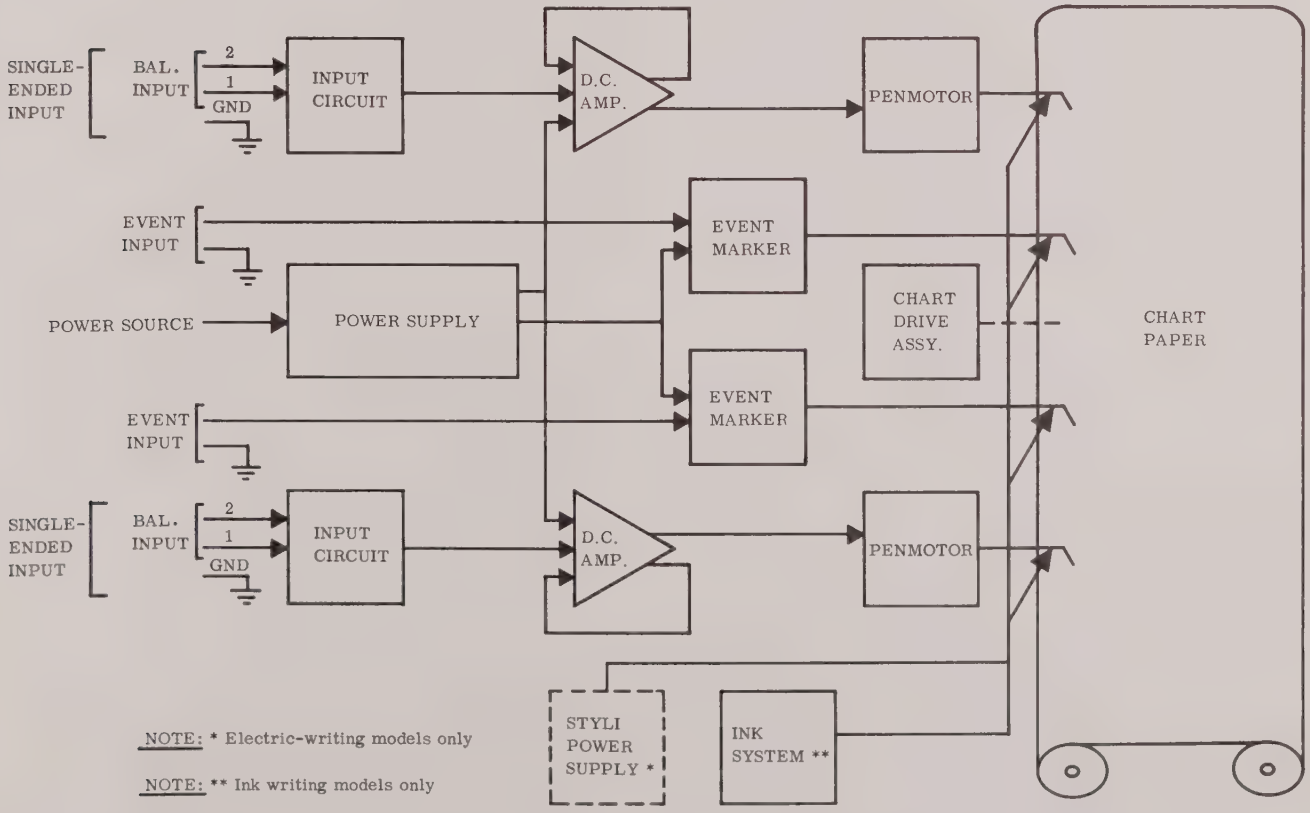


Figure 4.1 Block Diagram - Mark II Recorder

4.2. D.C. AMPLIFIER

A constant resistance attenuator in the input circuit provides the means of varying the input level to the first stage of the amplifier circuit. This attenuator always presents a 5 megohm resistance to a single-ended signal source, or a 10 megohm resistance to a balanced signal source throughout the attenuator range. At the ".01" position of the VOLTS/CHART LINE switch the input signal is not attenuated.

For single-ended (grounded) operation, input signals are connected to the amplifier between INPUT 2 and GROUND or INPUT 1 terminals. Half of the attenuator is used to couple signals to one grid of input tube V-101 (reference schematic for Model RD 2522-20).

For balanced operation, both sections of the attenuator are used to couple signals (connected between INPUT 1 and INPUT 2 terminals) to the grids of input tube V-101.

Input tube V-101, a high gain dual triode, is used as a differential D.C. amplifier. This stage effectively reduces, through cathode degeneration, the unwanted in-phase component of the input signal.

The desired differential component of the input signal is applied between the two input grids of V-101 with opposite polarities. Since the signal currents flowing through the common cathode resistor are of opposite polarities, no degeneration occurs at that point. Gain is controlled by the degeneration resistance connecting the two cathodes of V-101. Variation of the resistance with the calibrated gain adjustment, or the SENSITIVITY control, varies degeneration, and thus controls gain of the input stage. If the two halves of the input stage are not perfectly balanced, variation of the SENSITIVITY control will produce, in effect, a differential input signal, which is undesirable. Such an effect is eliminated by the BALANCE potentiometer adjustment, which provides compensation for tube unbalance. At the plate circuits of the input stage, output voltages are summed with feedback voltages from amplifier output circuit, and coupled to succeeding amplifier stages.

The second and third stages consist of two high gain dual triodes (V-102, V-103) used as conventional direct-coupled differential amplifiers. A pen bias control is provided in the second stage to permit positioning oscillograph pen on the chart ± 20 lines, by varying the relative D.C. bias on each half of V-102.

The third stage tube (V-103) is coupled to a pair of medium gain dual triodes (V-104, V-105), which operate as a bridge output circuit. The sections of each output tube appear at opposite arms of the bridge, so that the penmotor coil is, in effect, the load across the bridge.

Negative feedback paths from the output stage to summing points in the plate circuits of the input tube (V-101) provide D.C. feedback to stabilize overall gain. The A.C. negative feedback around these paths may be reduced with increasing frequency by two capacitors connected across the feedback networks. Recorder frequency response adjustment is accomplished by varying the effect of one of these capacitors, through use of a dual potentiometer in the feedback network. A switch is provided on this dual potentiometer to disconnect the two capacitors across the feedback networks.

4.3. OSCILLOGRAPH

The Oscillograph contains pen or styli, penmotors, chart paper, writing table, and chart paper drive mechanism. The chart speed control, a five position switch, selects either of the four speeds available, or the OFF position. In the OFF position, power is removed from the synchronous chart drive motor and penmotors are disconnected from the output of the D.C. amplifiers. In electric writing models, power is also removed from the styli power supply transformer. Pressing any of the chart speed buttons releases the OFF button, applies power to the chart drive motor, selects desired chart speed, and connects penmotors to output circuits of the D.C. amplifiers. In electric writing models, power is also applied to the styli power supply, if the bezel is closed.

The penmotor utilizes the familiar D'Arsonval galvanometer type mechanism in which the coil is used to deflect a pen or stylus. The penmotor

consists of a coil supported by jewelled bearings and mounted in the magnetic field of an Alnico V structure. A signal current passing through the coil causes, by motor action, a deflection of the coil about its axis; the deflection in turn causes movement of the writing pen or stylus which is affixed to the coil. The Brush penmotor differs from the classical galvanometer with its delicate hair springs, in that it makes use of a heavy torsion spring which maintains zero position of the coil, and also holds the coil in its upward bearing by supplying a downward force. Symmetrical clipper diode CR-1 provides protection from excessive current in penmotor coil. Temperature sensitive resistor RT-1 compensates for changing load conditions in the penmotor coil due to variations in ambient temperature.

In ink writing models pen motion is converted to chart traces through pens supplied by a closed ink system. In electric-writing models traces are produced on voltage sensitive chart paper by styli which are supplied by a constant current source.

Each event marker assembly transforms on-off signal information (0 volts D.C. and approximately 24 volts D.C.) into two-position information of the pen or stylus on chart paper. This is accomplished through motor action of a coil, attached to the pen drive shaft, and suspended in a magnetic field. Power is applied to this coil from the internal power supply, and actuated by external switches Some models of the Mark II recorder feature a front-panel pushbutton paralleling the external connection for actuation of the left-hand event marker. (See Specifications)

4.4. POWER SUPPLY

The power supply (Reference Schematic for model RD 2522-20) provides series type regulation for plate voltage, approximately 24 volts for event marker actuation, and also provides an A.C. filament voltage. Models RD 2521-20, RD 2521-10 and RD 2522-20 supply regulated D.C. voltage to the stage 1 and 2 filaments of the D.C. amplifiers. Models RD 2522-20 and RD 2522-00 provide a constant current supply for the electric-writing styli.

High voltage from transformer T-1 is rectified in a 6BW4 tube, (V-301) and applied to the plates of 12B4A series regulator tubes (V-302, V-303). This output voltage is compared at grid (Pin 2) of V-304 with voltage from reference tube V-305. This comparison determines if the +B supply agrees with the desired voltage, as preset on the bleeder (R-308, R-309, and R-310). If not, a voltage change proportional to the error appears at the plate (Pin 1) of V-304 and is amplified by the other half of V-304 and applied to the 12B4A series regulator tubes. This correcting action is continuous, regulating output voltage for varying conditions of load and input voltage.

The +B output of the power supply is connected to the -B output by a voltage divider (R-313, R-314), which establishes the potential from -B to chassis ground.

Approximately 24 volts D.C. is also supplied by transformer T-1 through the combined action of rectifier CR-301 and capacitor C-302. This voltage is supplied through current limiting resistor R-302 to event markers K-1 and K-2 and to filament regulator Q-1.

Regulated filament voltage for the D.C. amplifier tubes V-101 and V-102 is supplied by Q-1. Voltage reference element CR-302 maintains a constant bias voltage on the base of Q-1, which in turn maintains a constant voltage across the emitter load (V-101, V-102 filaments).

Electric-writing models supply styli current by means of an additional power supply consisting of transformer T-2, a full wave voltage doubler circuit, and series current limiting resistors. The full wave voltage doubler circuit (CR-2, CR-3, C-7, and C-8) supplies approximately 385 volts D.C. across bleeder resistor R-32. The series current path of R-31 and the individual styli resistors limit writing current to approximately 4 to 6 milliamperes with S-9 in the open position. With S-9 in the closed position, writing current is approximately 6 to 8 milliamperes.

The recorder has been balanced and adjusted accurately before shipment from the factory, and

should give long, trouble-free service. For any servicing other than that described in this manual, the instrument should be sent to one of the Brush service facilities (listed on the Warranty page), where it can be restored to original condition.

5.1. GENERAL

To insure proper operation of the Mark II Recorder, follow maintenance procedures carefully.

5.2. PRECAUTIONS

Always disconnect power cable when servicing or chart paper loading operations are carried out.

Keep watches, chronometers, and similar instruments away from recorder.

Do not drop recorder or tap penmotors with a hammer.

Prevent dirt, dust, metal filings, and the like from entering penmotors.

If either penmotor is damaged, remove from recorder and send to factory for repairs. Special equipment is required for magnetization and coil alignment.

5.3. PEN AND STYLI MAINTENANCE

Maintenance procedures for pens and styli being generally alike, those procedures pertaining to pens shall be discussed.

When removing or replacing pens always use pen mounting tool supplied with the instrument. Do not spread grooved sides of penholder unnecessarily or force penholder in any way because permanent damage to penholder or to upper bearing of penmotor will result.

5.3.1. PEN REMOVAL

1. REMOVE RECORDER FROM CASE

   Loosen knurled screws which hold chassis, then remove recorder from case. (Reference (Fig. 5.1).

2. REMOVE PEN

   Use Pen Mounting Tool to spread penholder just enough to slide pen tongue from penholder (Reference Fig. 5.2), then disconnect capillary tube from pen. (Disconnect wire from terminal block on electric writing models.)

Figure 5.1 Remove Recorder From Case

Figure 5.2 Remove Pen

5.3.2. PEN INSTALLATION

1. POSITION STYLI

Connect capillary tube to pen. (Connect wire to terminal block on electric writing models.) (Reference Fig. 5.3) Position yoke of pen over the penholder so that tongue is aligned with penholder grooves.

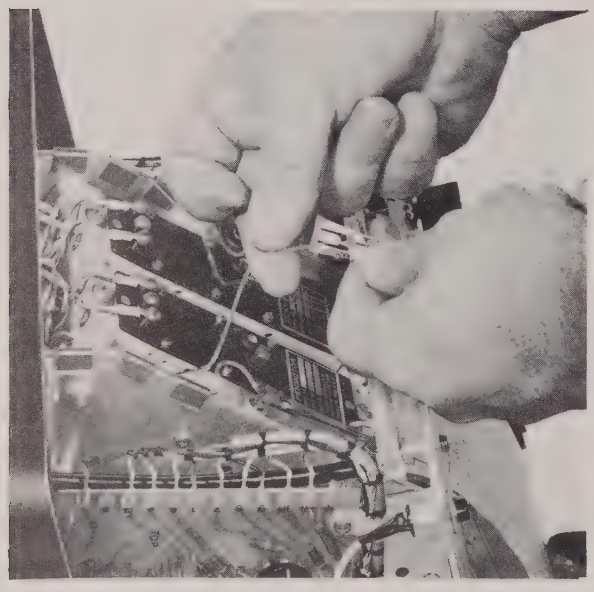


Figure 5.3 Connect Capillary Tube

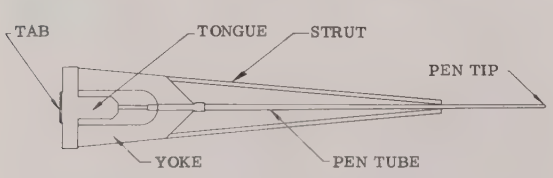


Figure 5.4 Pen Diagram

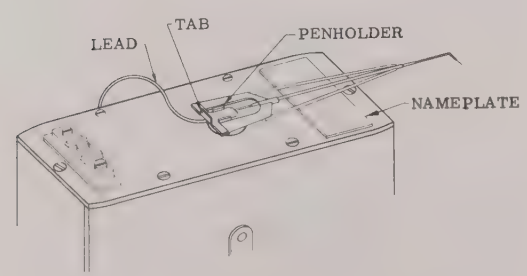


Figure 5.5 Pen Mounting Diagram

2. SPREAD PENHOLDER

Use the pen mounting tool to spread the penholder slightly, then slide tongue of pen into penholder grooves as far as possible.

Figure 5.6 Pen Properly Mounted

3. ALIGN PENMOTOR PEN TIPS

If one pen tip is farther forward then the other when both are seated as far as possible into penholder, spread penholder slightly and slide pen farthest forward back until it is aligned with the other.

4. ALIGN EVENT MARKER PEN TIPS

Align Event Marker pen tips with the intersection of curved analog and chart edge printed lines.

5. REPOSITION RECORDER

Press primer buttons until ink flows (ink writing models only). Return recorder to its case and tighten knurled fastening screws.

5.3.3. PEN PRESSURE ADJUSTMENT

Proper pen or styli pressure is an important factor for producing satisfactory writing characteristics. The styli on electric writing models should exert between .5 and .75 gram pressure on the chart paper.

Optimum pen pressure may vary for ink writing models, according to data recorded. If recording from D.C. to 100 cps, pen tip should apply from .5 to .75 gram pressure to chart paper. If most recordings will be made at frequencies from D.C. to 10 cps, with maximum amplitude of 10 mm peak-to-peak, a pen pressure of .35 gram is recommended. If most recordings will be made at frequencies from 10 to 100 cps, a pen pressure of 1.25 grams may be used.

The pen pressure measurement is important, and should be accurately made.

1. CHECK PRESSURE

   Place hook of the Brush gram gage, supplied, 1/32 inch behind pen tip, then raise gage. The reading is taken just as tip is lifted from paper. (Reference Fig. 5.7)

Figure 5.7 Pressure Measurement

2. PRESSURE TOO GREAT

   If pen pressure is too great, exert upward pressure on the pen yoke by raising tip from the chart paper a few times (Reference Fig. 5.8). Recheck pressure and repeat if necessary until proper reading is obtained.

Figure 5.8 To Reduce Pressure

3. PRESSURE TOO LOW

   If pen pressure is too low, remove pen from penholder and slightly bend tongue upward to change tongue and yoke relationship. Remount pen and measure pressure. Repeat adjustment if necessary until correct pressure is obtained. (Reference Fig. 5.9)

5.4. INK RESERVOIR REPLACEMENT

Replace ink reservoir as follows:

1. REMOVE REAR DOOR

2. REMOVE RESERVOIR

   Lift reservoir from clamp and unscrew reservoir from cover (Reference Fig. 5.10).

Figure 5.9 To Increase Pressure

Figure 5.10 Remove Reservoir

3. INSTALL REPLACEMENT RESERVOIR

   Remove cover from replacement reservoir and screw replacement reservoir securely into cover in the recorder. (Reference Fig. 5.11)

Figure 5.11 Replace Reservoir

4. SECURE RESERVOIR

   Place reservoir in clamp, and close rear door.

5. PRIME PENS

   Open front door and press primer buttons until ink flows from all pens (Reference Fig. 5.12).

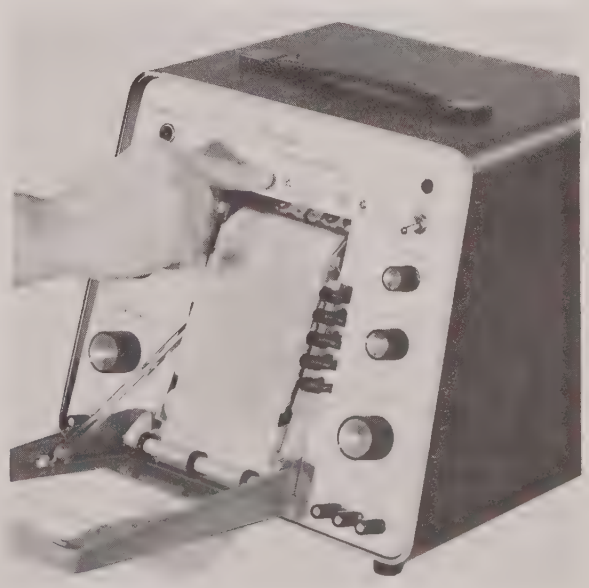


Figure 5.12 Priming Pens

6. CLOSE FRONT DOOR

Close front door of Recorder.

5.5. INK SYSTEM CLEANING PROCEDURE

A completely enclosed ink system is used on ink writing recorders. This prevents foreign material from entering the ink system, and prevents excessive evaporation of ink. However, for optimum performance, the cleaning procedures described below should be followed every three months of operation.

5.5.1. CLEAN INK PENS

1. REMOVE PENS

Remove pens from Recorder (Reference Paragraph 5.3.1), fill Brush plastic syringe with water, and insert pen tip in syringe needle.

NOTE: The pen tip is tapered inside; water must enter pen through the pen tip. Water flowing through pen in wrong direction will cause further clogging.

2. FLUSH PENS

Depress syringe plunger, forcing water through pen tip and pen until pen is cleared. If necessary, soak pen in water overnight, then repeat cleaning procedure.

3. INSTALL PENS (Reference Paragraph 5.3.2)

5.5.2. CLEAN INK LINES

1. REMOVE RESERVOIR

Open rear door of Recorder. Loosen screws on clamp securing reservoir to chassis, and lift reservoir from clamp. Unscrew reservoir from cover.

2. FILL RESERVOIR WITH WATER

Soak reservoir in water and rinse thoroughly. Fill reservoir with water to within 1/4 inch of top. Screw reservoir securely into cover, and position reservoir in clamp on chassis.

3. REMOVE PENS (Reference Paragraph 5.3.1)

4. FLUSH INK LINES

Depress and release primer buttons on front of Recorder to pump water from reservoir through ink lines, catching water in a suitable container as it is expelled from lines.

5. REPLACE RESERVOIR

When ink lines are rinsed thoroughly, lift reservoir from clamp, and unscrew reservoir from cover. Screw replacement reservoir into cover and place in clamp on chassis. Tighten clamp screws securely and close rear door.

6. REPLACE PENS AND PRIME

Install pens on Recorder (Reference Paragraph 5.3.2) and with front door open, depress and release primer buttons to expel water in lines and prime pens, catching water in suitable container. Continue until ink flows freely from all pens as primer buttons are depressed.

7. CLOSE FRONT DOOR

Close front door of Recorder.

5.6. LUBRICATION

Perform the following lubrication procedures every 250 hours of operation.

Remove chart paper and, with writing table pulled upward to limit, lift one side of gear cover with a screw driver. Tilt cover and remove from Recorder. Apply lubricant sparingly. Use Stanoil #35 or Gulfcrest "C" lubricant for wick type oilers on motor and sintered bearings in transmissions; use Lubriplate (140 or APG 90 or equivalent) for exposed gears and clutches. Replace gear cover and chart paper. Lubricants may be obtained locally.

5.7. TUBE REPLACEMENT

All tubes in the Recorder are accessible for replacement when the case is removed. No adjustment is required following replacement of tubes in the recorder power supply. However, when a tube has been replaced in an amplifier channel, that channel must be balanced (Reference Paragraph 3.5), and calibrated (Reference Paragraph 5.9).

5.8. BALANCING

For balancing procedure, refer to Paragraph 3.5.

5.9. CALIBRATION

5.9.1. SENSITIVITY

The instrument has been calibrated at the factory so that VOLTS/CHART LINE setting equals pen or stylus deflection when SENSITIVITY control is in the x1 position. Should it become necessary to recalibrate the Recorder, allow the unit to warm up for approximately 15 minutes, then proceed as follows:

1. REMOVE FROM CASE

   Loosen locking screws, remove instrument from case and connect to power source.

2. POSITION SWITCHES

   Place SENSITIVITY switch to the x1 position and place POWER switch ON. Place attenuator to .05 position.

3. APPLY CALIBRATION VOLTAGE

   Apply an accurate 1.0 volt D.C. voltage to INPUT terminals 1 and 2.

4. ADJUST FOR 20 LINES DEFLECTION

   Adjust CALIBRATION control, located on rear of PEN BIAS control, for 20 lines deflection.

5. REPLACE UNIT

   Replace the unit in its case and fasten the locking screws.

5.9.2. FREQUENCY COMPENSATION

The Mark II Recorder is adjusted for optimum frequency response at the factory. Should readjustment become necessary, proceed as follows:

1. CONNECT OSCILLATOR

   Connect an oscillator which covers the range from 10 to 100 cps to INPUT terminals number 1 and number 2. Use shielded leads to minimize hum pickup.

2. POSITION SWITCHES

   Place VOLTS/CHART LINE switch to 10 position and operate the instrument at a 25 mm/sec CHART SPEED (10 mm/sec for model RD 2522-00). Use the PEN BIAS control to center stylus on chart paper. Place FREQUENCY COMPENSATION control, located on rear of instrument, to approximately mid-position.

3. ADJUST FOR 10 LINES DEFLECTION

   Adjust oscillator frequency to 10 cps and output level for 10 lines total pen deflection (peak-to-peak). Adjust VOLTS/CHART LINE switch on Recorder if necessary to obtain 10 lines deflection. The oscillator output voltage is a reference voltage and must be held constant during the frequency compensation procedure. The VOLTS/CHART LINE switch and SENSITIVITY control must also remain unchanged.

4. ADJUST CONTROL

   At 100 cps, with oscillator output voltage the same in step number 3, adjust FREQUENCY COMPENSATION control as necessary to obtain a pen deflection of 10 chart lines.

5. ADJUST IF NECESSARY

Sweep the frequency range from 10 cps to 100 cps. Hold oscillator output voltage constant and check for flatness of response. Adjust FREQUENCY COMPENSATION control, if necessary, to obtain optimum response from 10 cps to 100 cps.

5.10. HUM BALANCE ADJUSTMENT

Mark II Recorders, Model numbers RD 2521-00 and RD 2522-00 are equipped with a hum balance control (Reference Fig. 5.13) which is factory adjusted so that no appreciable hum or noise appears on recording (with no input signal applied).

Noise or hum indicated on the chart may be reduced as follows:

1. REMOVE REAR COVER

2. GROUND INPUT

Connect INPUT 1 and 2 terminals to GROUND (both channels).

3. STABILIZE TEMPERATURE

Connect power cable to power source and place POWER switch ON. Allow Recorder to warm up for 15 minutes.

4. ADJUST HUM BALANCE CONTROL

Press CHART SPEED "5" button ("2" on Model RD 2522-00) and adjust hum balance control to produce minimum trace on both channels.

5. REMOVE POWER

Press CHART SPEED OFF button, place POWER switch OFF and disconnect power cable from power source.

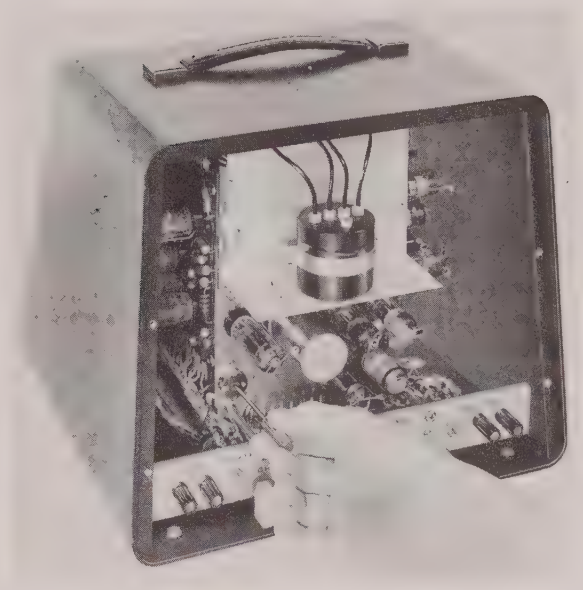


Figure 5.13 Hum Balance Adjustment

6. REPLACE REAR COVER

Remove ground from input terminals and replace rear cover on Recorder.

5.11. TROUBLESHOOTING

The following chart lists symptoms and probable causes of improper operation or failure of the Recorder to operate, as well as probable remedies for unsatisfactory operating conditions.

Conditions described in the chart are for all models of Brush Mark II Recorders, unless noted otherwise, operating from a 60 cps 115 volt power source. Procedures suggested in "Remedy" column may be performed by operating personnel.

Before checking trouble symptoms against chart, see that all quick connectors are securely connected to wiring boards.

TABLE 5-1 TROUBLE SHOOTING - GENERAL

SYMPTOM	CAUSE	REMEDY
1. Recorder does not operate; panel light off. (Model RD 2522-00 chart lights off)	a. Power cable disconnected.	a. Connect power cable.
	b. No power line voltage	b. Connect recorder to proper power source.
	c. Fuse open	c. Replace fuse.
	d. Defective POWER switch	d. Replace defective switch.
2. Pens do not deflect; panel light on. (Model RD 2522-00 chart lights on)	a. Rectifier tube 6BW4 defective.	a. Replace defective tube.
	b. Cabling defective between amplifier and penmotor.	b. Repair cable
	c. Defective 12B4A, 125833 or 12AX7 tube.	c. Replace defective tube.
	d. Interspeed muting of switch open or defective.	d. Depress appropriate CHART SPEED button or replace defective switch.
3. Analog pens deflect; event pens do not deflect.	a. Defective 24 volt D.C. power supply.	a. Refer to Table 5-3, Item 2.
4. Event pens deflect; analog pens do not deflect.	a. Regulated 12 volt D.C. filament supply defective. (Models RD 2521-20, RD 2521-10 and RD 2522-20 only.)	a. Replace defective zener diode, series resistor, filter capacitor or transistor. NOTE: Also see Cause and Remedy for "2" above.

TABLE 5-2 TROUBLESHOOTING - AMPLIFIER SECTION

SYMPTOM	CAUSE	REMEDY
1. Amplifier operates, and can be balanced; noise or hum indicated on chart.	a. Hum balance control out of adjustment. (Models RD 2521-00 and RD 2522-00 only)	a. Adjust as described in Paragraph 5.10.
	b. Lack of shielding at amplifier input.	b. Shield input terminals.
	c. Defective 12AX7, 125833 or 5687 tube (cathode to filament leakage).	c. Replace defective tube, balance and calibrate amplifier channel.
	d. Defective filter capacitor.	d. Replace defective filter capacitor.
	e. Unregulated +B voltage	e. See Table 5-3.
2. Amplifier operates and can be balanced; drifts excessively.	a. Power line voltage below 105 V or above 125 V	a. Connect recorder to proper power source.
	b. Defective 12AX7 or 125833 tubes.	b. Replace defective tubes, balance and calibrate amplifier channel.
	c. +B to -B voltage varies.	c. See Table 5-3.
3. Amplifier operates and can be balanced; PEN BIAS control does not operate.	a. Defective 125833 tube.	a. Replace defective tube.
	b. Defective PEN BIAS control.	b. Replace defective control.
	c. Open resistor from arm of PEN BIAS control to -B.	c. Replace defective resistor.
4. Maximum sensitivity less than 20 chart lines (mm) with SENSITIVITY control full clockwise.	a. Insufficient power line voltage.	a. Connect recorder to proper power source.
	b. Weak 12AX7, 125833, 5687, 6BW4 or 12B4A tube.	b. Locate and replace defective tube.
	c. Defective resistor between cathode of 12AX7 tube and x1 switch on SENSITIVITY control.	c. Replace defective resistor and reset calibrated gain control as described in Paragraph 5.9.

TABLE 5-2 TROUBLESHOOTING - AMPLIFIER SECTION (Cont)

SYMPTOM	CAUSE	REMEDY
5. Sensitivity at x1 position of SENSITIVITY control inaccurate	a. Weak 12AX7, 125833, 5687, 6BW4 or 12B4A tube.	a. Locate and replace defecfective tube.
	b. Calibrated gain control (on rear of PEN BIAS control) improperly adjusted.	b. Reset calibrated gain control as described in Paragraph 5.9.
	c. Defective resistor between cathode of 12AX7 tube and x1 switch on SENSITIVITY control.	c. Replace defective resistor and reset calibrated gain control as described in Paragraph 5.9.
6. Amplifier can be balanced and calibrated, but is nonlinear.	a. Defective 12AX7, 125833, or 5687 tubes.	a. Replace defective tubes, balance and calibrate amplifier channel.
7. Sensitivity incorrect at certain VOLTS/CHART LINE switch position.	a. Defective resistor in attenuator network.	a. Replace defective resistor
8. Amplifier channel cannot be frequency compensated to penmotor.	a. Defective resistor or capacitor in compensation network.	a. Locate and replace defective resistor or capacitor.

TABLE 5-3 TROUBLESHOOTING - POWER SUPPLY SECTION

SYMPTOM	CAUSE	REMEDY
1. +B to -B regulated voltage varies, is erratic, or is of wrong value.	a. Insufficient power line voltage.	a. Connect recorder to proper power source.
	b. Defective 6BW4, 12B4A, 12AX7 or 5651 tube.	b. Locate and replace defective tube.
	c. Defective filter capacitor.	c. Replace defective capacitor.
	d. Defective resistor or capacitor	d. Replace defective resistor or capacitor.

TABLE 5-3 TROUBLESHOOTING - POWER SUPPLY SECTION (Cont)

SYMPTOM	CAUSE	REMEDY
2. 24 Volt D.C. supply voltage low.	a. Defective diode or filter capacitor.	a. Replace defective diode or filter capacitor.
	b. Defective series resistor. NOTE: Models RD 2521-20, RD 2521-10 and RD 2522-20 only.	b. Replace defective series resistor.
3. 12 Volt D.C. filament voltage is wrong value. NOTE: Models RD 2521-20, RD 2521-10 and RD 2522-20 only.	a. Supply voltage too low.	a. See "2" above.
	b. Reference voltage is of wrong value.	b. Replace defective zener diode, series resistor or filter capacitor.
	c. Transistor defective	c. Replace defective transistor.
4. Insufficient current supplied to styli. NOTE: Models RD 2522-20, and RD 2522-00 only.	a. Bezel interlock switch defective.	a. Replace defective switch.
	b. Full-wave voltage doubler circuit defective	b. Replace defective diode (CR-2, CR-3) or capacitor (C-7, C-8).
	c. Defective bleeder or current-limiting resistor.	c. Replace defective resistor.

TABLE 5-4 TROUBLESHOOTING - RECORDER SECTION

SYMPTOM	CAUSE	REMEDY
1. Crosstalk between penmotors.	a. Penmotor circuit grounded.	a. Locate and eliminate ground.
2. Stylus or pen continues to indicate signal when CHART SPEED OFF button is depressed.	a. Defective interspeed muting switch.	a. Repair or replace defective switch. NOTE: S-6 in RD 2522-20 Schematic.
3. Pen cannot be primed with primer pushbuttons. NOTE: Models RD 2521-00, RD 2521-10 and RD 2521-20 only.	a. No ink in ink reservoir.	a. Install replacement reservoir
	b. Clogged pen or ink system.	b. Clean pen or ink system as described in Paragraph 5.5.

TABLE 5-4 TROUBLESHOOTING - RECORDER SECTION (Cont)

SYMPTOM	CAUSE	REMEDY
4. Stylus leaves no trace on chart paper. NOTE: Models RD 2522--00 and RD 2522-20.	a. Incorrect chart paper used.	a. Install correct chart paper, see Paragraph 1.3.
	b. Insufficient current supplied to styli.	b. Refer to Table 5-3, Item 4.
5. Chart drive motor does not operate, pilot light on (Model RD 2522-00 chart lights are on).	a. Defective transmission actuated power switch.	a. Replace defective switch. NOTE: S-4 in RD 2522-20 Schematic.
	b. Defective motor.	b. Replace defective motor.
6. CHART SPEED buttons will not remain engaged.	a. Broken flat spring on latching bar.	a. Replace broken spring.
	b. Worn latching bar.	b. Replace chart speed push-button assembly.
7. CHART SPEED button will not release.	a. Borken coil spring on pushbutton assembly.	a. Replace chart speed push-button assembly.
8. CHART SPEED button does not select proper chart speed.	a. Inoperative transmission.	a. Return Recorder to factory service department for repair.
9. Chart does not move when CHART SPEED buttons are depressed.	a. Motor not operating.	a. See 5 above.
	b. Defective gear in gear train or transmission.	b. Return Recorder to factory service department for repair.

6.1 EXPLODED VIEW PARTS LIST

TABLE 6.1 EXPLODED VIEW PARTS LIST
MODELS RD 2521-10, RD 2521-20 and RD 2521-20 (restyled)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
1	744506	Hood Assembly	RD 2521-20*
2	20-119922-0208	Screw	
3	8-120052-306	Washer, Lock	
4	427697-910	Bezel Assembly	RD 2521-10, RD 2521-20
4	744599	Door Assembly	RD 2521-20*
5	231778	Window	RD 2521-10, RD 2521-20
5	244568	Window	RD 2521-20*
6	31-119920-4206	Screw	
7	244561	Bar, Pull	RD 2521-20*
8	227288-910	Roller Assembly	
9	127334	Bracket	
10	127283-1	Shaft	
11	10-120053-101	Washer	
12	31-119918-4004	Screw	
13	128017-4002	Set Screw	
14	1-227070-3	Ring, Grip	
15	31-119918-6205	Screw	
16	5-120053-305	Washer	
17	231968	Switch, Push, SPST (S-7)	
18	227464-910	Bracket Asm., Plunger	RD 2521-10
18	241194-910	Bracket Asm., Plunger	RD 2521-20, RD 2521-20*
19	227337-910	Plunger Assembly	RD 2521-10
19	241195-920	Plunger Assembly	RD 2521-20, RD 2521-20*
20	126621	Indicator, Neon (DS-1)	
21	121068	Switch (S-3)	
22	226342	Knob, Small	
23	4-106766-1	Nut, Hex	
24	127390	Resistor, Variable (R-22)	
25	226343	Knob, Medium	
26	4-106766-1	Nut, Hex	
27	127251	Resistor, Variable w/switch (R-21, S-2)	
28	127135	Can	
29	226344	Knob, Large	
30	4-106766-1	Nut, Hex	

TABLE 6.1 EXPLODED VEIW PARTS LIST (cont.)
MODELS RD 2521-10, RD 2521-20 and RD 2521-20 (restyled)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
31	427344-910	Switch Assembly (A-1)	
32	127457	Jumper	
33	126395-3	Binding Post (J-1)	
34	126395-3	Binding Post (J-1)	
35	126395-3	Binding Post (J-1)	
36	126395-3	Binding Post (J-1)	
37	126395-3	Binding Post (J-1)	
38	126395-3	Binding Post (J-1)	
39	226344	Knob, Large	
40	4-106766-1	Nut, Hex	
41	427344-910	Switch Assembly (A-1)	
42	226343	Knob, Medium	
43	4-106766-1	Nut, Hex	
44	127251	Resistor, Variable, w/switch (R-21,S-2)	
45	226342	Knob, Small	
46	4-106766-1	Nut, Hex	
47	127390	Resistor, Variable (R-22)	
48	227317	Retainer, Paper Roll	
49	127319	Spring, Torsion, Helical	
50	127318	Shaft, Paper Retainer	
50a	8-120052-103	Washer	
51			
51	31-119918-4004	Screw	
52	1-127070-6	Ring	
53**	647715	Gear, Idler	
53a**	248278	Shaft, Stud, Idler Gear	
53b**	127270	Spacer	
54	127831-PL1	Transmission Assembly	RD 2521-10
54	441277-915	Transmission Assembly	RD 2521-20, RD 2521-20*
55	127327	Shaft	
56	327704-910	Table Assembly, Writing	RD 2521-10
56	329986-910	Table Assembly, Writing	RD 2521-20, RD 2521-20*
56a	228453-910	Spindle Asm., Paper Roll	
57	31-119920-8205	Screw	
58	231909	Spacer	
59	20-119922-0224	Screw	
60	332318-915	Board Assembly, (WB-1)	

TABLE 6.1 EXPLODED VIEW PARTS LIST (cont.)
MODELS RD 2521-10, RD 2521-20 and RD 2521-20 (restyled)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
61	440218-920	Side Plate, L.H.	
62	31-119918-0206	Screw	
63	127331	Mount, Penmotor	
64	20-119922-0208	Screw, Flat Head	
65	127330	Penmotor Adjuster	
66	232383	Event Marker Stop	
67	8-120052-105	Washer, Lock	
68	31-119918-8204	Screw	
69	127270	Washer, Flat	
70	8-120052-107	Washer, Lock	
71	31-119918-0210	Screw	
72	RA 2821-31	Pen Assembly, Rigid	
73	227665-910	Event Marker Assembly, L.H.	
74	240215	Mount, Penmotor	
75	128196	Resistor, Thermal (RT-1)	
76	31-119918-0210	Screw	
77	8-120052-107	Washer, Lock Int.	
78	127270	Washer, Flat	
79	127329	Penmotor Locator (rear)	
80	31-119918-6205	Screw	
81	5-120053-102	Washer, Lock	
82	240189	Bracket, Terminal, R.H.	
83	227665-920	Event Marker Assembly (K-2)	
84	226408-910	Board Assembly, Terminal	
85	5-120053-102	Washer, Lock	
86	31-119918-6205	Screw	
87	31-119918-6206	Screw	
88	20-119922-0208	Screw, Flat Head	
89	128678	Cover, Inkwell	RD 2521-10
89	242438	Cover, Inkwell	RD 2521-20, RD 2521-20*
90	242451-910	Tube Assembly	
91	342513-910	Ink Valve Assembly	RD 2521-20, RD 2521-20*
91	227647-910	Valve Assembly	RD 2521-10
92	127608	Bottle	
93	242471	Tube, Left Analog Channel	RD 2521-20, RD 2521-20*
93a	242453	Tube, Left Event Channel	RD 2521-20, RD 2521-20*
94	242458	Tube, Right Event Channel	RD 2521-20, RD 2521-20*
94a	242472	Tube, Right Analog Channel	RD2521-20, RD 2521-20 *
94a	126264	Tubing, Thermoplastic	RD 2521-10
95	340249-910	Housing, Fan Assembly	

TABLE 6.1 EXPLODED VIEW PARTS LIST (cont.)
MODELS RD 2521-10, RD 2521-20 and RD 2521-20 (restyled)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
96	1-216741-420	Washer	
97	31-119998-62	Nut	
98	241166-910	Bracket Assembly, Inkwell	
99	121936	Motor, Fan (B-2)	
100	232504	Impeller, Fan	
101	31-119918-6205	Screw	
102	7-118195-207	Washer, Flat	
103	232211	Transistor, Type 2N176 (Q-1)	
104	12-120735-610	Screw	
105	10-120053-104	Washer	
106	31-119918-0206	Screw	
107	20-119922-0206	Screw	
108	31-119998-62	Nut	
109	10-120053-102	Washer	
110	122228-2	Plate	
111	31-119918-6205	Screw	
112	232732	Capacitor (C-6)	
113	13-119918-6205	Screw	
114	332318-915	Board Assembly (WB-1)	
115	1-117802-1254	Resistor (R-106)	
116	1-117802-2503	Resistor (R-104)	
117	1-117802-2004	Resistor (R-109)	
118	1-117802-4703	Resistor (R-129)	
119	125216	Socket, 9 pin	
120	125835	Tube, 12AX7 (V-101)	
121	122828	Tube, 5687 (V-105)	
122	122828	Tube, 5687 (V-104)	
123	125833	Tube, Selector (V-103)	
124	125833	Tube, Selected (V-102)	
125	5-117264-101	Capacitor (C-101)	
126	1-117802-4703	Resistor (R-128)	
127	1-117802-1724	Resistor (R-130)	
128	1-117802-3004	Resistor (R-123)	
129	1-117802-1724	Resistor (R-127)	
130	5-115559-112	Resistor (R-133)	

TABLE 6.1 EXPLODED VIEW PARTS LIST (cont.)
MODELS RD 2521-10, RD2521-20 and RD 2521-20 (restyled)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
131	125216	Socket, 9 pin	
132	1-117802-5103	Resistor (R-119)	
133	5-115557-273	Resistor (R-126)	
134	5-115557-104	Resistor (R-124)	
135	5-117264-681	Capacitor (C-103)	
136	1-117802-3004	Resistor (R-132)	
137	5-115557-104	Resistor (R-125)	
138	125216	Socket, 9 pin	
139	5-117264-471	Capacitor (C-104)	
140	1-117802-1104	Resistor (R-121)	
140a	1-117802-4703	Resistor (R-131)	
141	5-117264-101	Capacitor (C-102)	
142	5-117265-332	Capacitor (C-105)	
143	1-117802-3004	Resistor (R-122)	
144	1-117802-5103	Resistor (R-120)	
145	1-117802-2004	Resistor (R-112)	
146	1-117802-1254	Resistor (R-108)	
147	1-117802-3503	Resistor (R-107)	
148	1-117802-2503	Resistor (R-105)	
149	1-117802-1254	Resistor (R-111)	
150	1-117802-1003	Resistor (R-116)	
151	5-115557-362	Resistor (R-115)	
152	125216	Socket, 9 pin	
153	1-117802-1002	Resistor (R-113)	
154	1-117802-1104	Resistor (R-118)	
155	5-115557-152	Resistor (R-103)	
156	5-115557-153	Resistor (R-102)	
157	1-117802-1254	Resistor (R-110)	
158	5-115557-153	Resistor (R-101)	
159	125216	Socket, 9 pin	
160	1-117802-2352	Resistor (R-117)	
161	5-115557-362	Resistor (R-114)	
162	31-119918-4006	Screw	
163	1-120053-201	Washer	
164	20-119922-0208	Screw	
165	244288	Switch (1/2 S-6)	

TABLE 6.1 EXPLODED VIEW PARTS LIST (cont.)
MODELS RD 2521-10, RD 2521-20 and RD 2521-20 (restyled)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
166	244301	Switch (1/2 S-6)	
167	8-120052-101	Washer, Lock	
168	22-119917-2612	Screw	
169	31-119918-6208	Screw	
170	5-120053-105	Washer	
171	4-127528-2	Washer, Lock	
172	127291	Latch Spring	
173	127289	Guide, Switch Blade	
174	227519-910	Blade Assembly	
175	231132	Button, Push	
176	231132	Button, Push	
177	231132	Button, Push	
178	231132	Button, Push	
179	231132	Button, Push	
180	31-119914-2608	Screw	
181	127521	Switch (S-4)	
182	108513	Flat Washer	
183	20-119922-5006	Screw	
184	2-216741-15	Washer, Spring	
185	3-109142-5	Washer, Flat	
186	3-109142-5	Washer, Flat	
187	127325	Bracket, Panel	
188	227297-910	Lever Asm., Short	
189	227300-910	Lever Asm., Medium	
190	127788	Actuator Arm	
191	227303-910	Lever Asm., Long	
192	127326	Bracket	
192a	127533	Nut Plate	
193	845148-142	Penmotor	
194	845148-142	Penmotor	
195	227396	Power Transformer (T-1)	RD 2521-10
195	229283	Power Transformer (T-1)	RD 2521-20, RD 2521-20*
196	10-120053-104	Washer, Lock	
196a	31-119998-02	Nut, Hex	
197	227728-910	Bracket Assembly	
198	5-130488-254	Capacitor (C-4)	
199	1-117802-3004	Resistor (R-25)	
200	126255	Resistor, Variable w/switch (S-5,R-26)	

TABLE 6.1 EXPLODED VIEW PARTS LIST (cont.)
MODELS RD 2521-10, RD 2521-20 and RD 2521-20 (restyled)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
201	5-122233-242	Capacitor (C-5)	
202	332852-915	Board Assembly (WB-2)	
203	125216	Socket, 9 pin	
204	1-117803-5002	Resistor (R-314)	
205	1-117802-7502	Resistor (R-313)	
206	5-115558-473	Resistor (R-312)	
207	5-115557-330	Resistor (R-304)	
208	125216	Socket, 9 pin	
209	5-115557-102	Resistor (R-303)	
210	5-115557-225	Resistor (R-305)	
211	1-117802-3302	Resistor (R-308)	
212	5-115557-330	Resistor (R-306)	
213	232537	Capacitor (C-302A, C-302B)	
214	127152	Capacitor (C-301A, C-301B, C-301C)	
215	125216	Socket, 9 pin	
216	10-125905-103	Capacitor (C-303)	
217	31-119918-6210	Screw	
218	10-125905-104	Capacitor (C-304)	
219	1-117802-3902	Resistor (R-310)	
220	1-117802-3302	Resistor (R-309)	
221	5-115557-101	Resistor (R-311)	
222	124390	Tube 12B4A (V-303)	
223	130198-1	Rectifier (CR-301)	
224	124390	Tube, 12B4A (V-302)	
225	5-115557-224	Resistor (R-307)	
226	127179	Socket, 7 pin	
227	232253	Semiconductor 1N1524 (CR-302)	
228	5-115558-561	Resistor (R-301)	
229	10-111111-5Ro	Resistor (R-302)	
230	126997	Tube, 6BW4 (V-301)	
231	240853	Tube, 5651 (V-305)	
232	125835	Tube, 12AX7 (V-304)	
233	1-117802-3004	Resistor (R-25)	
234	126255	Resistor, Variable w/switch (S-5, R-26)	
235	5-122233-242	Capacitor (C-5)	

TABLE 6.1 EXPLODED VIEW PARTS LIST (cont.)
MODELS RD 2521-10, RD 2521-20 and RD 2521-20 (restyled)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
236	5-130488-254	Capacitor (C-3)	
237	126395-3	Binding Post (J-2)	
238	126395-3	Binding Post (J-2)	
239	19-211473-502	Resistor, Variable (R-23)	
240	119365	Fuse Holder (XF-1)	
241	126295-7	Cable, Power (P-1)	
242	105982-1	Strip, Terminal (TB-1)	
243	20-125905-103	Capacitor (C-1)	
244	20-125905-103	Capacitor (C-2)	
245	31-216741-15	Washer	
246	31-119998-62	Nut, Hex	
247	31-119918-6206	Screw	
248	108572-5	Insulator, Strain	
249	19-211473-502	Resistor, Variable (R-23)	
250	126395-3	Binding Post (J-3)	
251	126395-3	Binding Post (J-3)	
252	440207-910	Case Asm	RD 2521-10, RD 2521-20
252	844387	Case Asm	RD 2521-20*
253	31-119918-8214	Screw	RD 2521-10, RD 2521-20
253	31-119918-8210	Screw	RD 2521-20*
254	2-120053-103	Lockwasher	
255	120903-214	Bumper	RD 2521-10, RD 2521-20
255	245050	Bumper	RD 2521-20*
256	7-120053-103	Lockwasher	
257	31-119998-82	Nut	
258	127492	Block, Chassis Retaining	
259	127491	Screw, Knurled	
260	31-119918-0208	Screw	
261	7-120053-104	Lockwasher	
262	7-118195-209	Washer	
263	31-119998-02	Nut	RD 2521-20*
264	7-120053-104	Lockwasher	RD 2521-20*
265	7-118195-209	Washer	RD 2521-20*

TABLE 6.1 EXPLODED VIEW PARTS LIST (cont.)
MODELS RD 2521-10, RD 2521-20 and RD 2521-20 (restyled)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
266	11-127513-2	Handle	RD 2521-10, RD 2521-20
266	243485	Handle	RD 2521-20*
267	440579	Cover, Rear	RD 2521-10, RD 2521-20
267	444374	Cover, Rear	RD 2521-20*

*Restyled model

**Replaced old style Jan. 1965

NOTE: Use Transmission 441277-925 with RD 2521-20 recorders operated at 50 cps.

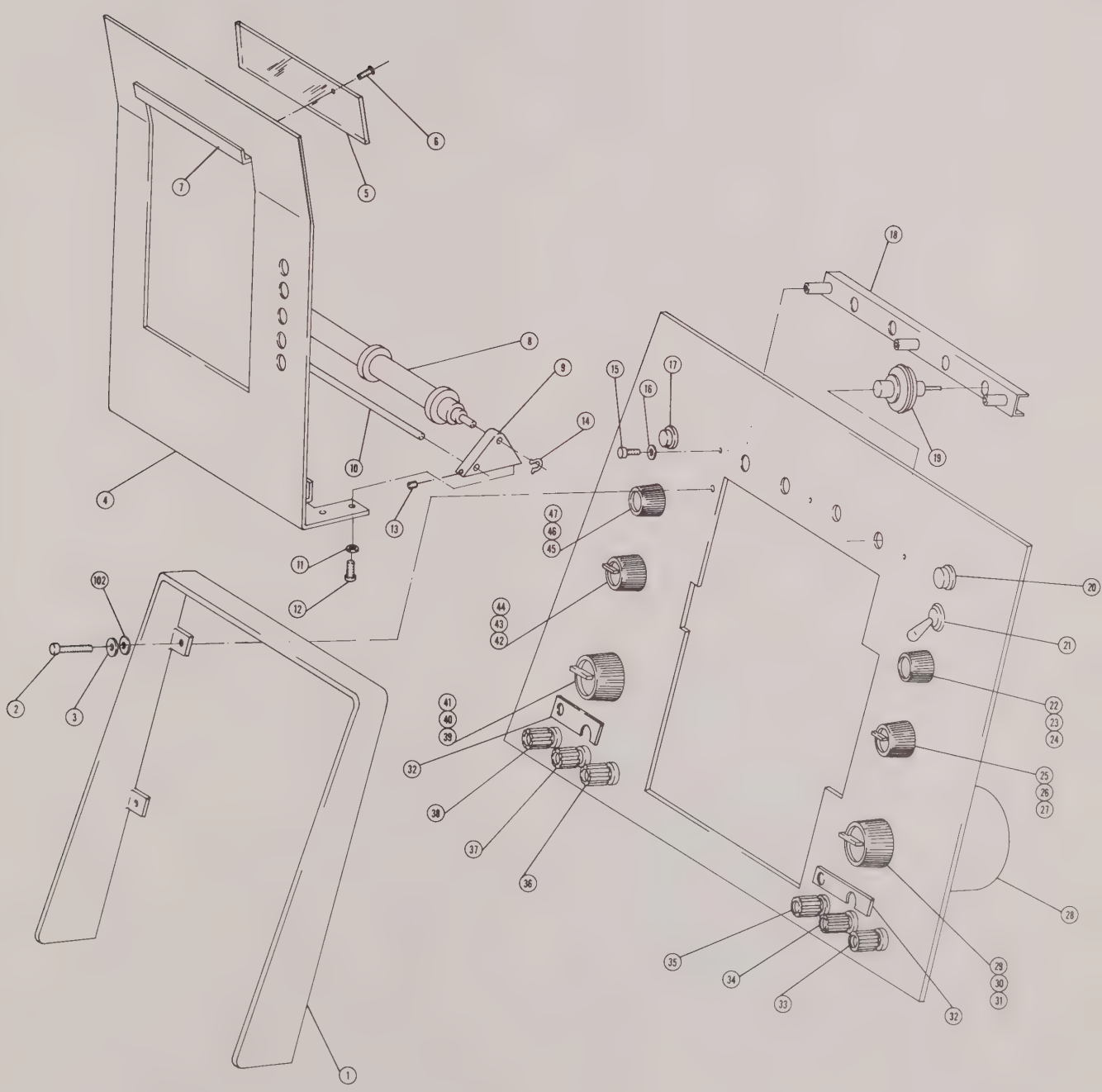
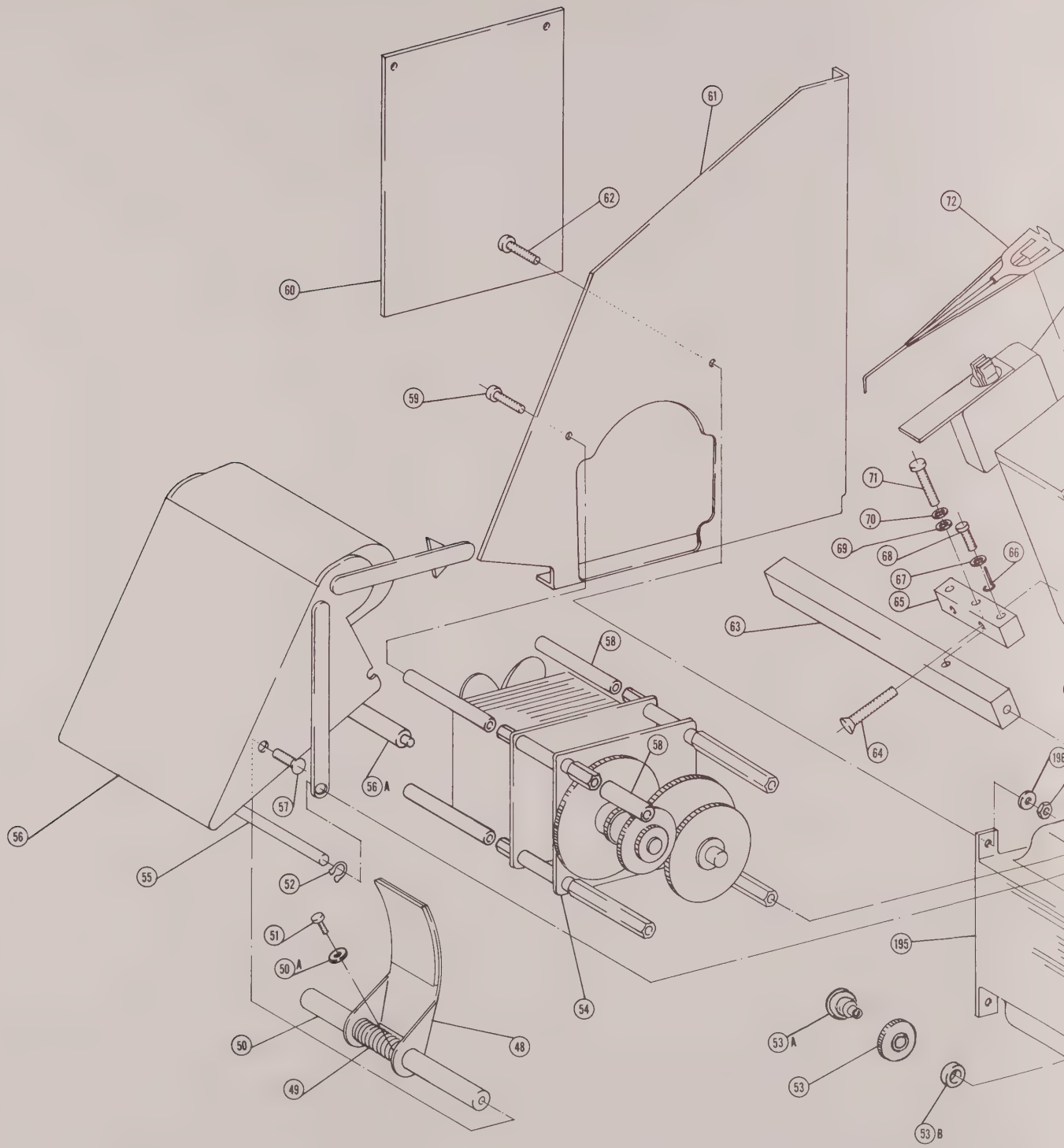


Figure 6.1 a RD 2521-20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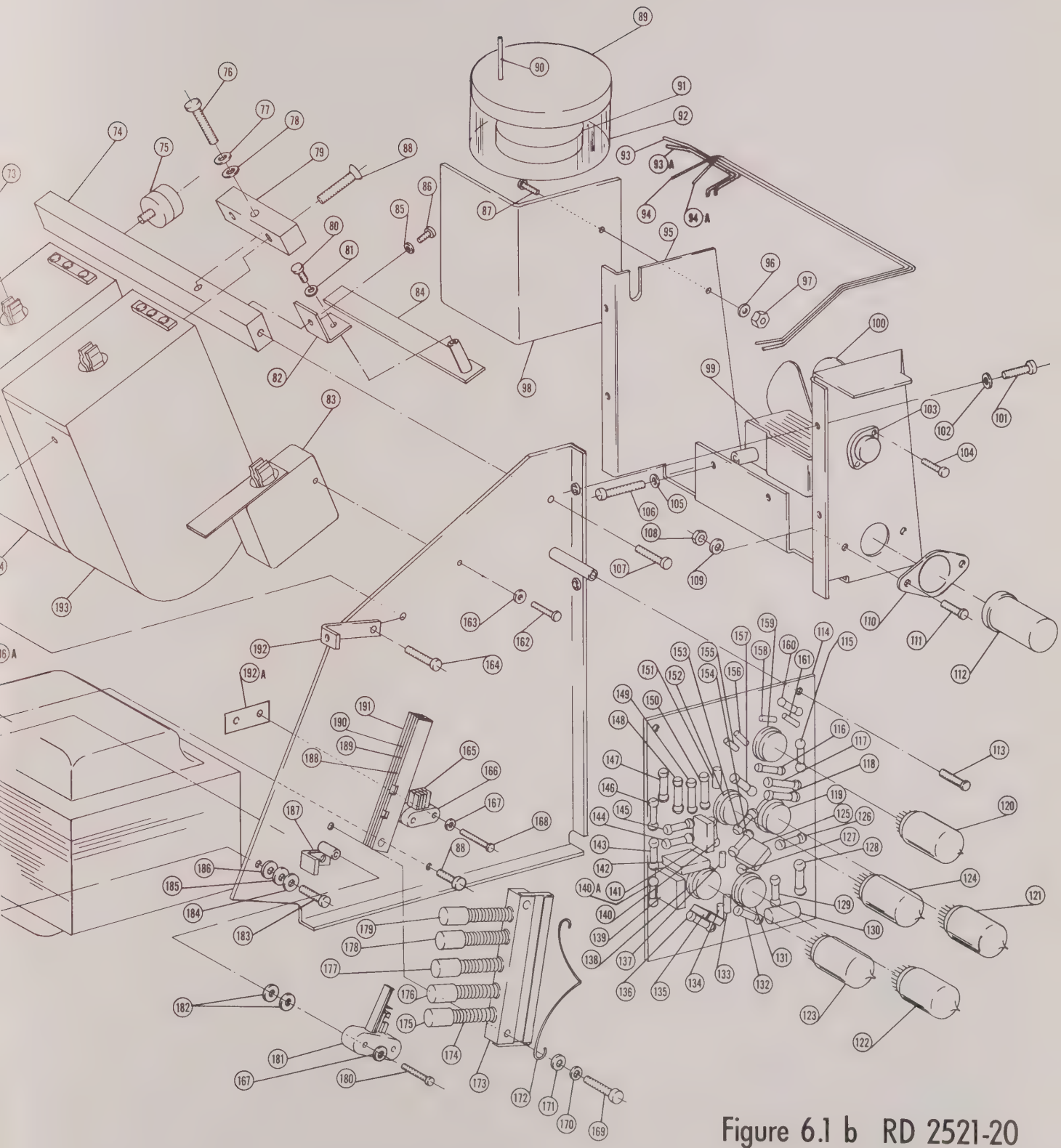


Figure 6.1 b RD 2521-20

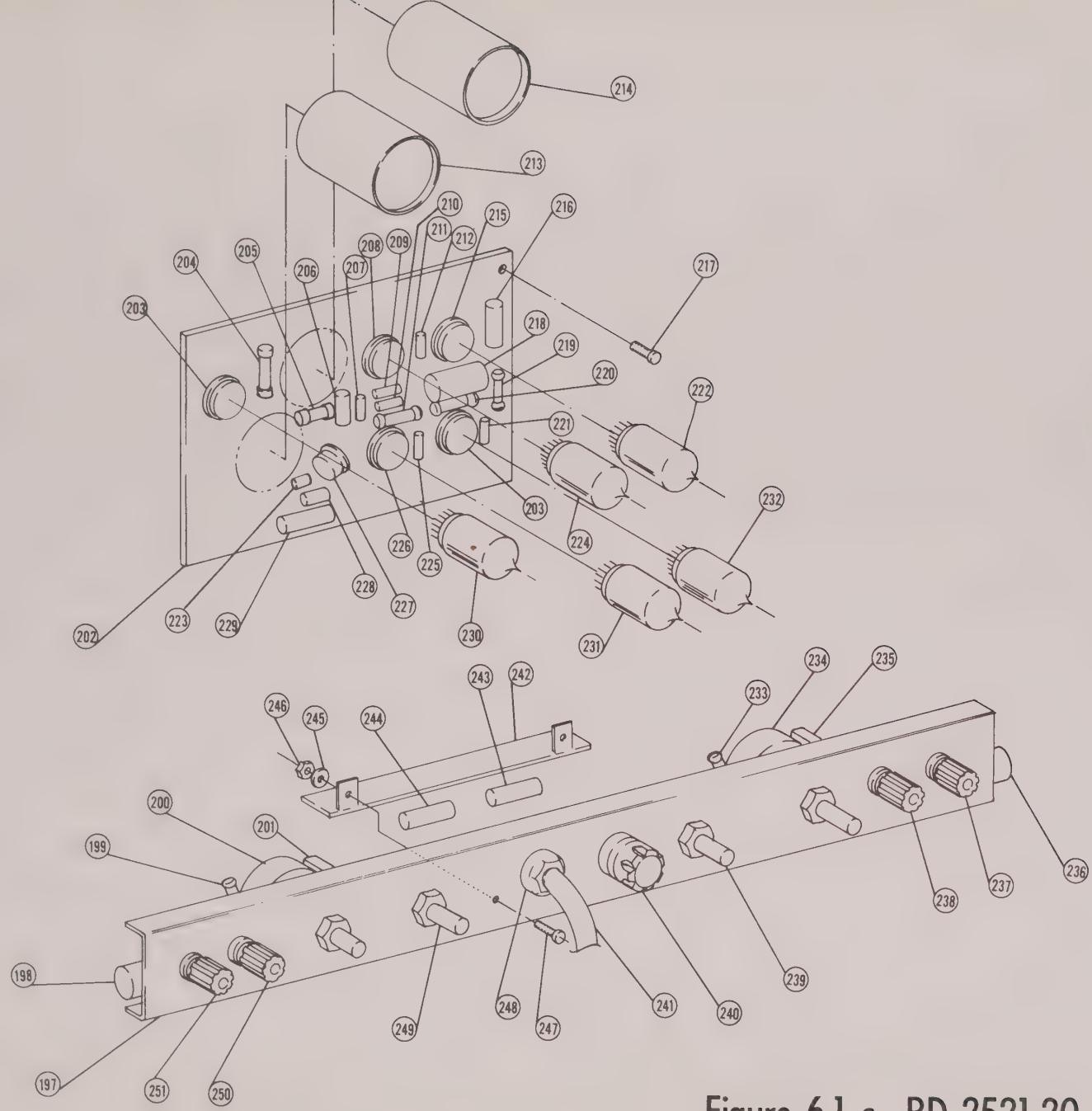


Figure 6.1 c RD 2521-20

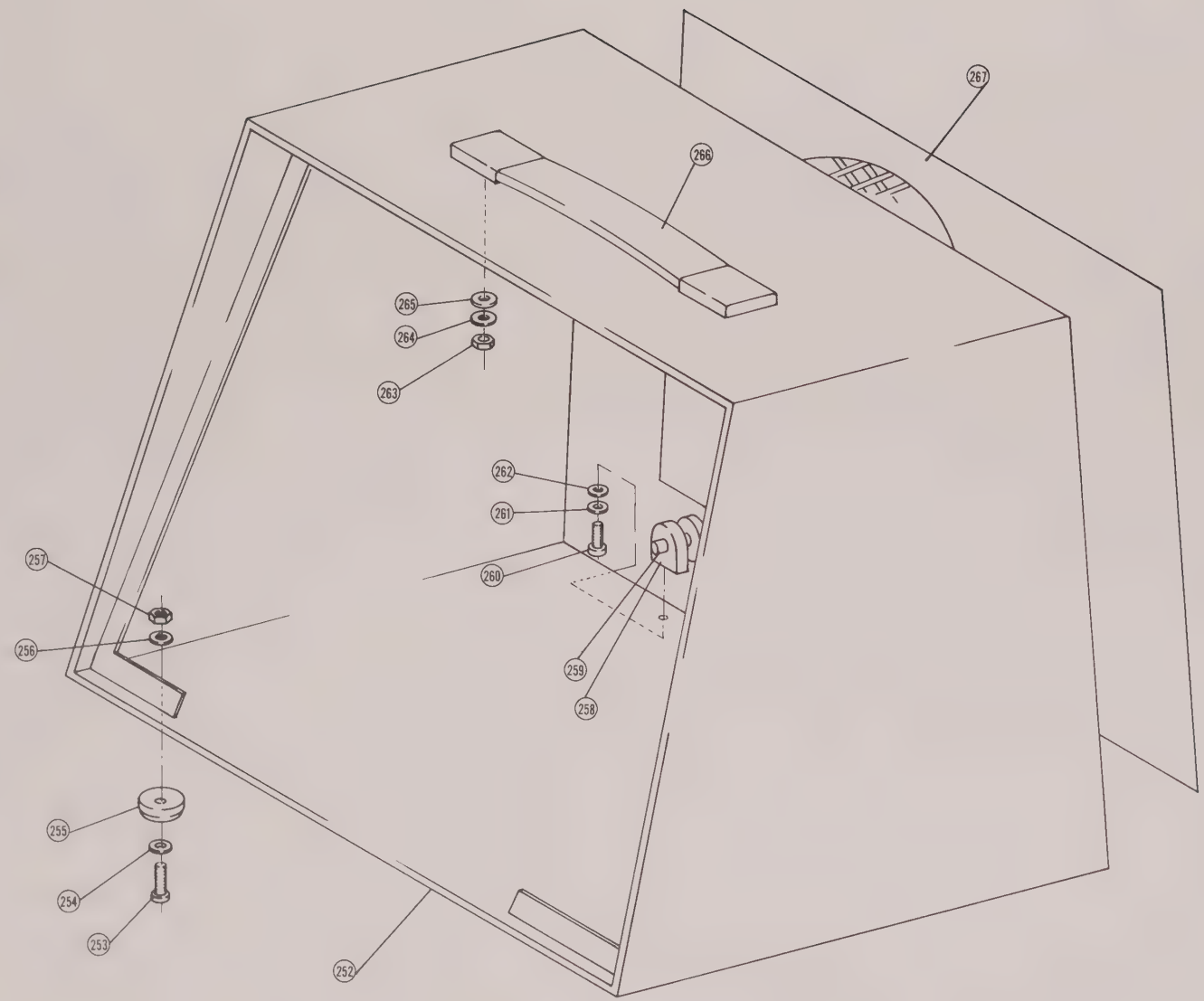


Figure 6.1 d RD 2521-20

TABLE 6.2 EXPLODED VIEW PARTS LIST - MODELS RD 2521-00 and RD 2522-00

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
1	427709-910	Case Assembly	RD 2521-00
1	430337-910	Case Assembly	RD 2522-00
2	227505-910	Back Subassembly	RD 2521-00
2	330313	Back, Case	RD 2522-00
3	13-126906-806	Screw	
4	7-120053-103	Washer, Lock	
5	127700	Clip	
6	3-119551-8208	Screw, Knurled	RD 2521-00
7	5-118195-207	Washer, Plain	RD 2521-00
8	127637	Fastener, Adjustable	RD 2521-00
9	120903-214	Bumper, Recessed	
10	12-119998-82	Nut	
11	7-120053-103	Washer, Lock	
12	12-119918-8208	Screw	
13	127492	Block, Chassis Retaining	
14	31-119918-0208	Screw	
15	7-120053-104	Washer, Lock	
16	127491	Screw, Knurled	
17	1-127070-6	Ring, Retaining	
18	11-127513-2	Handle, Case	
19	127469	Slide, Lift	
20	229428	Slide, Guide	
21	12-119918-8208	Screw	
22	7-120053-103	Washer, Lock	
23	427697-910	Bezel Assembly	RD 2521-00
23	427697-920	Bezel Assembly	RD 2522-00
24	231778	Window	
25	231779	Support, Bezel	
26	12-119918-6202	Screw	
27	7-120052-105	Washer, Lock	
28	430296-910	Panel Subassembly, Front	RD 2522-00
28	427343-910	Panel Subassembly, Front	RD 2521-00
29	121068	Switch, S.P.S.T. (S-3)	
30	226342	Knob, Small	

TABLE 6.2 EXPLODED VIEW PARTS LIST, MODELS RD 2521-00 and RD 2522-00 (Cont)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
31	127390	Resistor, Variable (R-22, R-24)	
32	226343	Knob, Medium	
33	127251	Resistor & Switch Assembly (R-21, S-2)	
34	226344	Knob, Large	
35	122220	Cover, Spring Clip	
36	427344-910	Switch Assembly, Volt/Chart Line (A-1)	
37	227219	Switch, Rotary (S-1)	
38	50-117802-5001	Resistor	
39	50-117802-1502	Resistor	
40	50-117802-2502	Resistor	
41	50-117802-5002	Resistor	
42	50-117802-1503	Resistor	
43	50-117802-2503	Resistor	
44	50-117802-5003	Resistor	
45	50-117802-1504	Resistor	
46	50-117802-2504	Resistor	
47	121785	Paper, Insulation	
48	127135	Can, Modified	
49	126621	Indicator, Neon	RD 2521-00
50	126395-3	Post, Binding	
51	127457	Jumper, Binding Post	
52	127293	Blade, Switch	
53	127292	Spring, Blade return	
54	231132	Button, Push	
55	4-217274-403	Pin	
56	127294	Silencer, Stop	
57	7-104636-8	Ball, Ball Bearing	
58	127289	Guide, Switch Blade	
59	12-119918-6208	Screw	
60	5-120052-105	Washer, Lock	
61	4-127528-2	Washer, Special	
62	127290	Latch, Bar Switch	
63	12-120746-0003	Screw, Self-tapping	
64	127291	Spring, Latch	
65	127788	Actuator, Switch, Penmotor	

TABLE 6.2 EXPLODED VIEW PARTS LIST, MODELS RD 2521-00 and RD 2522-00 (Cont)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
66	127789	Stiffener, Switch	
67	244301	Switch, Penmotor (1/2 S-6)	
68	22-119917-2612	Screw	
69	244288	Switch (1/2 S-6)	
70	127521	Switch (S-4)	
71	12-119914-2608	Screw	
72	7-120052-101	Washer, Lock	
73	227297-910	Lever Asm, Switch, Short	
74	1-127070-9	Ring, Retaining	
75	227306	Pawl, 1/4 inch shaft	
76	127463	Spring, Pawl return	
77	12-119998-40	Nut	
78	7-120053-101	Washer, Lock	
79	20-119922-4010	Screw, Cap	
80	227300-910	Lever Assembly, Switch, Medium	
81	227305	Pawl, 3/16 inch shaft	
82	127463	Spring, Pawl return	
83	12-119998-40	Nut	
84	7-120053-101	Washer, Lock	
85	20-119922-4010	Screw, Cap	
86	227303-910	Lever Assembly, Switch, Long	
87	227304	Pawl 1/8 inch shaft	
88	127465	Spring, Pawl return	
89	12-119998-40	Nut	
90	7-120053-101	Washer, Lock	
91	20-119922-4010	Screw, Cap	
92	329986-910	Table Assembly, Writing	RD 2522-00
92	327704-910	Table Assembly, Writing	RD 2521-00
93	227407-910	Plate Asm, R.H.	
94	12-119920-8205	Screw	
95	7-120053-103	Washer, Lock	RD 2521-00
95	1-120053-203	Washer, Lock	RD 2522-00

TABLE 6.2 EXPLODED VIEW PARTS LIST, MODELS RD 2521-00 and RD 2522-00 (Cont)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
96	127311-2	Arm	
97	127316	Shaft, Spacer	RD 2521-00
98	748208	Retainer Asm	
99	Not Used		
100	Not Used		
101	127318	Shaft, Paper Retainer	
102	127319	Spring, Torsion	
103	12-119918-4004	Screw	RD 2521-00
103	31-119918-4004	Screw	RD 2522-00
104	127327	Shaft, Arm	
105	1-127070-6	Ring, Retaining	
106	228453-910	Spindle Asm, Paper Roll	RD 2521-00
107	1-210761-1	Bearing Ball	
108	127281	Roll, Drive	
109	127271	Washer	
110	63-127640-5	Washer, Spring	
111	127286	Tube, Pressure Roll	
112	127287	Ring, Friction	
113	127283	Shaft, Pressure Roll	
114	1-210761-6	Bearing, Ball	
115	127524	Spacer, Pressure Roll	
116	127334	Hinge, Pivot Bar	
117	14-121166-4002	Screw, Set	
118	1-127070-3	Ring, Retaining	
119	5-118195-204	Washer, Plain, Light	
120	127328	Chute, Paper Guide	
121	127283	Shaft, Paper Chute	
122	127331	Mount, Penmotor	
123	20-119922-0208	Screw	
124	227573-910	Shield Assembly, Motor	
125	427462-910	Side Subassembly, Drive, R.H.	

TABLE 6.2 EXPLODED VIEW PARTS LIST, MODELS RD 2521-00 and RD 2522-00 (Cont)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
126	427461-910	Side Subassembly, Drive, L.H.	
127	127711-6	Bearing, Nylon	
128	227406-910	Arm Asm	
129	127271	Washer	
130	1-127070-9	Ring, Retaining	
131	127326	Bracket	
132	127325	Bracket, Panel	
133	20-119922-0224	Screw	
134	127831-PL1	Transmission & Motor Asm	RD 2521-00
134	330310	Transmission Asm	RD 2522-00
135	20-119922-0224	Screw	
136	20-119922-0208	Screw	
137	231909	Spacer	
138	647715	Gear Assembly, Idler	
139	14-127717-5005	Screw, Cap	
140	2-216741-15	Washer, Lock	
141	127270	Washer	
142	248278	Shaft, Stud, Idler Gear	
143	12-119918-6206	Screw	
144	7-120053-102	Washer, Lock	
145	227495	Shelf, Inkwell	RD 2521-00
146	123108-62	Grommet	RD 2521-00
147	226408-910	Board Asm, Terminal	RD 2521-00
147	230306-910	Board Asm, Terminal	RD 2522-00
148	12-119918-6204	Screw	
149	7-120053-102	Washer, Lock	
150	128196	Resistor, Thermal (RT-1)	
151	12-119998-02	Nut	
152	7-120053-104	Washer, Lock	RD 2521-00
152	22-216741-30	Washer, Lock	RD 2522-00
153	126425	Name Plate	
154	12-120730-202	Screw, Self Tapping	
155	227464-910	Bracket Assembly, Plunger	RD 2521-00

TABLE 6.2 EXPLODED VIEW PARTS LIST, MODELS RD 2521-00 and RD 2522-00 (Cont)

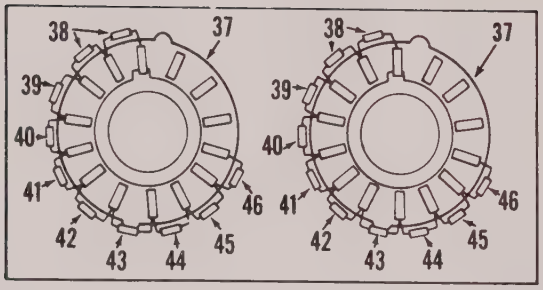
INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
156	227337-910	Plunger Assembly, Ink	RD 2521-00
157	126264	Tubing, Thermoplastic	RD 2521-00
158	128678	Cover, Inkwell	RD 2521-00
159	127608	Bottle	RD 2521-00
160	227647-910	Valve Assembly	RD 2521-00
161	128600	Tube, Inkwell	RD 2521-00
162	126264	Tubing, Thermoplastic	RD 2521-00
163	127489	Support, Bottle Holder	RD 2521-00
164	12-119918-6206	Screw	RD 2521-00
165	5-120053-102	Washer	RD 2521-00
166	220599	Lifter, Pen	RD 2521-00
167	11293-1	Pad, Felt	RD 2521-00
168	RA 2821-31	Pen Asm, Rigid	RD 2521-00
168	RA 2822-31	Stylus Assembly, Rigid	RD 2522-00
169	845148-142	Penmotor Assembly	
170	127330	Adjuster, Penmotor	
171	127329	Locator, Penmotor	
172	227665-910	Event Marker Asm, L.H.	
*	227665-920	Event Marker Asm, R.H.	
173	227396	Transformer, Power (T-1)	
174	227728-910	Bracket, Assembly, Control	
175	12-119918-0206	Screw	
176	7-120052-107	Washer, Lock	
177	126395-3	Post, Binding	
178	5-130488-254	Capacitor (C-3, C-4)	
179	126255	Resistor, Vari, dual w/switch (R-26, R-27, S-5)	
180	1-117802-3004	Resistor (R-25)	
181	5-122233-242	Capacitor (C-5)	
182	19-211473-502	Resistor, Variable (R-23)	
183	2-106766-1	Nut	
184	7-120053-108	Washer, Lock	
185	108572-5	Insulator, Cable Strain	
186	126295-7	Cable, Power (P-1)	
187	105982-9	Strip, Terminal	
188	20-125905-103	Capacitor (C-1, C-2)	
189	119365	Holder, Fuse	
190	102625-9	Fuse, Type 3AG (F-1)	

TABLE 6.2 EXPLODED VIEW PARTS LIST, MODELS RD 2521-00 and RD 2522-00 (Cont)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
191	327395-910	Board Asm, Power Supply (WB-2)	
192	12-119918-6206	Screw	
193	5-120053-102	Washer	
194	326988-920	Board Asm, Circuit D.C. Amp (WB-1)	
195	12-119918-6206	Screw	
196	5-120053-102	Washer, Lock	
197	128850-2	Clipper, Symmetrical (CR-1)	
198	RA 2821-32	Paper, Chart	RD 2521-00
198	RA 2922-22	Paper, Chart, Elec.	RD 2522-00

NOTE: Model RD 2521-05 identical to model RD 2521-00, with exception of Item 134, which is 847243.

* Not Illustrated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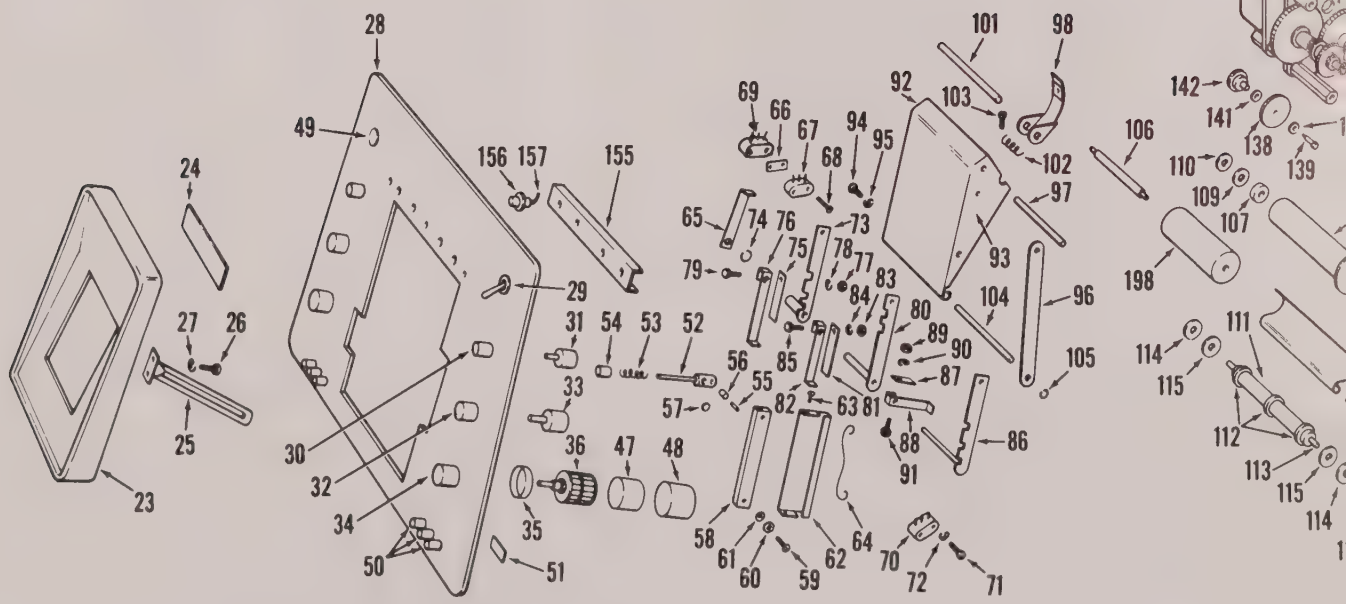
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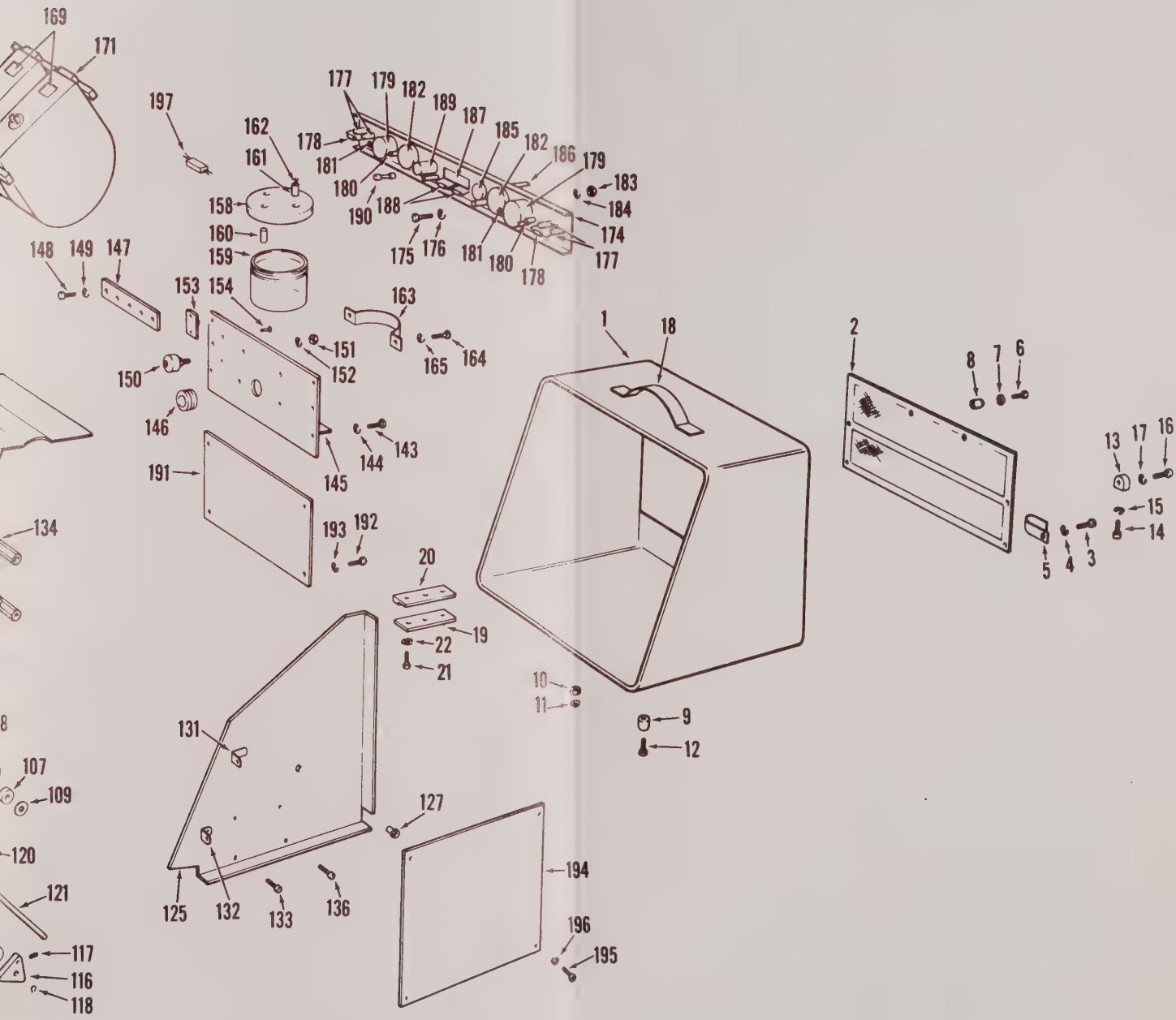


Figure 6.2 model RD 2521-00

TABLE 6.3 EXPLODED VIEW PARTS LIST - MODEL RD 2522-20

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
1	427697-930	Bezel Assembly	Original
1	744599	Door Assembly	Restyled
	744506	Hood Assembly	Restyled
2	231779	Support	
3	12-119918-6202	Screw	
4	7-120052-105	Lockwasher	
5	31-119914-2606	Screw	Original
5	12-119914-2604	Screw	Restyled
6	1-118195-303	Washer	
7	231778	Window	Original
7	244568	Window	Restyled
8	231968	Switch, Push, S.P.S.T. (S-7)	
9	105710-2	Lamp (DS-2, DS-3)	
10	127850	Lamp Holder	
11	3-128210-62	Nut	
12	5-120052-105	Lockwasher	
13	12-119918-6208	Screw	
14	126621	Indicator (DS-1)	
15	121068	Switch, Toggle	
16	127390	Resistor, Variable (R-22)	
17	226342	Knob, Small	
18	127251	Resistor, Variable (R-21)	
19	226343	Knob, medium	
20	126395-3	Post Binding (J-1)	
21	226344	Knob, large	
22	122220	Cover, Spring clip	
23	427344-910	Switch Asm, V/Chart Line (A-1)	
24	121785	Insulation	
25	127135	Can	
26	127457	Jumper	
27	227519-910	Blade Asm	
28	231132	Button Push	
29	127289	Guide, Switch Blade	
30	12-119918-6208	Screw	

TABLE 6.3 EXPLODED VIEW PARTS LIST - MODEL RD 2522-20 (Cont.)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
31	5-120052-105	Lockwasher	
32	4-127528-2	Washer	
33	127521	Switch (S-4)	
34	12-119914-2608	Screw	
35	7-120052-101	Lockwasher	
36	227303-910	Lever Asm, long	
37	244301	Switch (1/2 S-6)	
38	22-119917-2612	Screw	
39	127789	Stiffener	
40	244288	Switch (1/2 S-6)	
41	1-210761-6	Bearing, Pressure Roll	
42	5-118195-204	Washer	
43	227288-910	Pressure Roll Asm	
44	5-118195-204	Washer	
45	1-210761-6	Bearing, Pressure Roll	
46	1-118195-304	Spacer	
47	14-121166-4002	Screw	
48	1-227070-3	Ring, Clip	
49	127334	Hinge, Pivot Bar	
50	14-121166-4002	Screw	
51	127283	Shaft	
52	127328	Chute, Paper Guide	Original
52	244547	Chute, Paper Guide	Restyled
53	127281	Roll	
54	127524	Spacer, Pressure Roll	
55	1-210761-1	Bearing, Ball	
56	127271	Washer	
57	127271	Washer	
58	1-210761-1	Bearing, Ball	
59	RA2922-22	Paper, Chart Electric	
60	127327	Shaft	
61	329986-910	Table Asm, Writing	
62	748208	Retainer Assembly	
63	Not Used		
64	Not Used		
65	127318	Shaft, Paper Retainer	

TABLE 6.3 EXPLODED VIEW PARTS LIST - MODEL RD 2522-20 (Cont.)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
66	31-119918-4004	Screw	
67	127319	Spring, Torsion	
68	127283	Shaft	
69	228453-910	Spindle Asm, Paper Roll	
70	227406-910	Arm Assembly	
71	1-227070-9	Ring, Clip	
72	127271	Washer	
73	31-119918-0206	Screw	
74	229283	Transformer (T-1)	
75	441277-915	Transmission Asm	
76	20-119922-0208	Screw	
77	332318-915	Board Assembly, Printed Circuit (WB-1)	
78	31-119918-6206	Screw	
79	Non Procurable Part of R.H. Side Plate	Spacer	
80	332852-915	Board Assembly, Printed Circuit (WB-2)	
81	12-119918-6206	Screw	
82	7-120053-102	Lockwasher	
83	227573-910	Shield Assembly	
84	230320-910	Switch Asm, Interlock (S-8)	
85	31-119914-2606	Screw	
86	232184	Insulation	
87	230306-910	Board Asm, Power Supply, Styli	
88	12-119914-2606	Screw	
89	2-118195-203	Lockwasher	
90	11-127513-2	Handle	Original
90	243485	Handle	Restyled
91	228841-910	Stylus Assembly, Electric (Event)	
92	227665-910	Event Marker, L.H. (K-1)	
	227665-920	Event Marker, R.H. (K-2)	
93	845148-142	Penmotor Assembly (M-1)	
94	31-119920-8208	Screw	
95	130168	Connector, Receptacle (J-4)	
96	12-119916-2606	Screw	
97	341081-915	Stylus Assembly, Electric (Analog)	
98	128196	Resistor, Thermal	
99	232504	Impeller, Fan	
100	121936	Motor, Fan (B-2)	

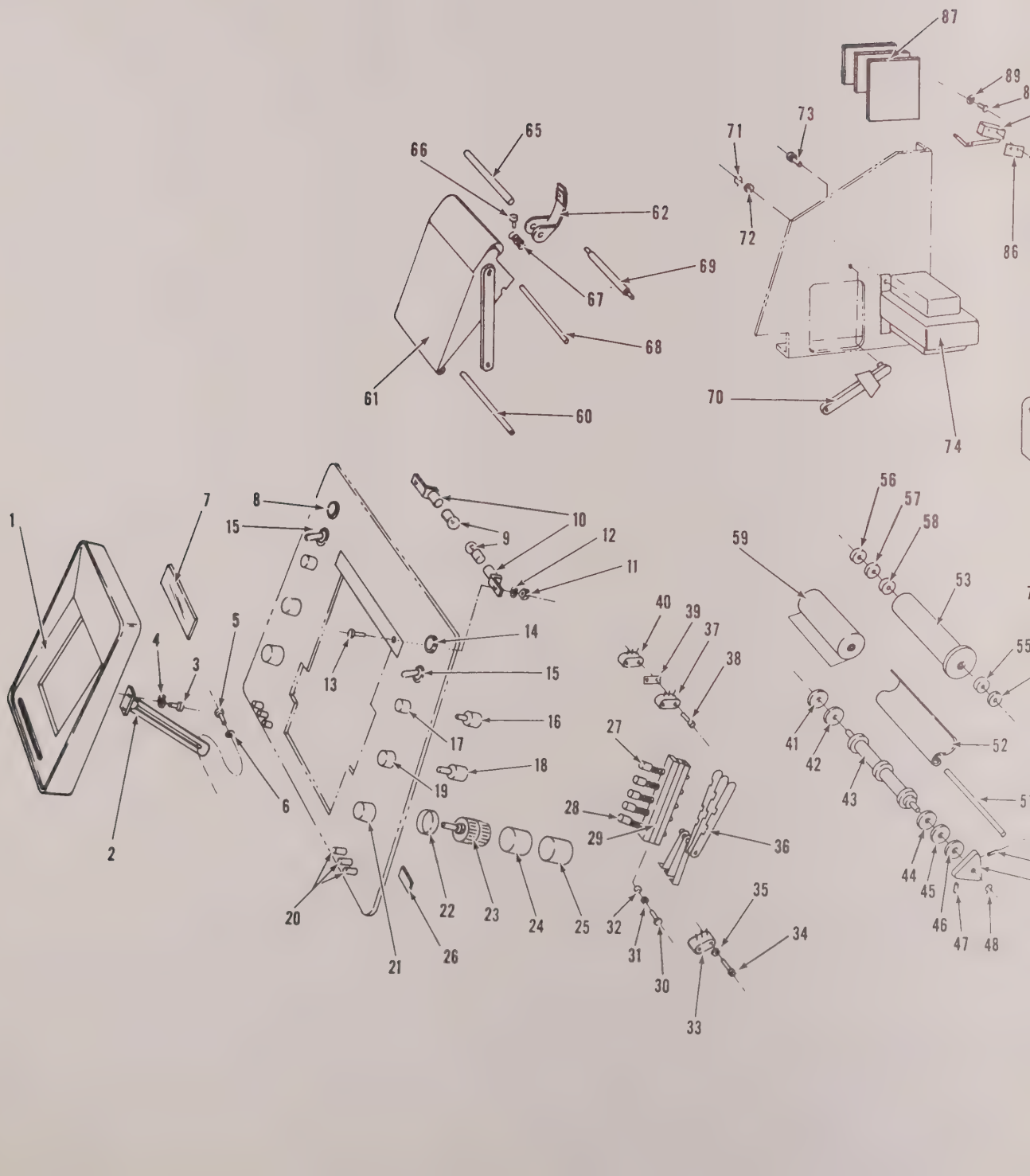
TABLE 6.3 EXPLODED VIEW PARTS LIST - MODEL RD 2522-20 (Cont.)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
101	31-119920-0206	Screw	
102	1-216741-430	Lockwasher	
103	440207-910	Case Assembly	Original
103	844387	Case Assembly	Restyled
104	440579	Cover, Rear	Original
104	444374	Cover, Rear	Restyled
105	3-119551-8208	Screw	
106	240578	Spacer, Latch	
107	127637	Fastener	Original
107	244626	Fastener	Restyled
108	127700	Clip	
109	31-119918-8208	Screw	
110	7-120053-103	Lockwasher	
111	240577	Stud, Back	
112	127492	Block, Chassis Retaining	
113	127491	Screw, Knurled	
114	1-227070-6	Ring, Clip	
115	31-119918-0208	Screw	
116	7-120053-104	Lockwasher	
117	245050	Bumper	
118	31-119918-8210	Screw	
119	31-119998-82	Nut	
120	7-120053-104	Lockwasher	
121	227728-910	Bracket Assembly	
122	31-119918-0206	Screw	
123	8-120052-107	Lockwasher	
124	127332	Standoff	
125	126295-7	Cable, Power (P-1)	
126	20-125905-103	Capacitor (C-1)	
127	119365	Fuseholder (XF-1)	
128	19-211473-502	Resistor, Variable (R-23)	
129	5-122233-242	Capacitor (C-5)	
130	126395-3	Post Binding (J-2)	
131	126395-3	Post Binding (J-2)	
132	5-130488-254	Capacitor	
133	126255	Resistor, w/switch (S-5, R-26)	
134	1-117802-3004	Resistor (R-25)	
135	20-125905-103	Capacitor (C-2)	

TABLE 6.3 EXPLODED VIEW PARTS LIST - MODEL RD 2522-20 (Cont.)

INDEX NO.	PART NUMBER	DESCRIPTION	REMARKS
136	19-211473-502	Resistor, Variable (R-23)	
137	126255	Resistor, Variable w/switch (S-5, R-26)	
138	1-117802-3004	Resistor (R-25)	
139	5-130488-254	Capacitor	
140	126395-3	Post Binding (J-3)	
141	126395-3	Post Binding (J-3)	

NOTE: Model RD 2522-25 identical with exception of item 75, which is 441277-925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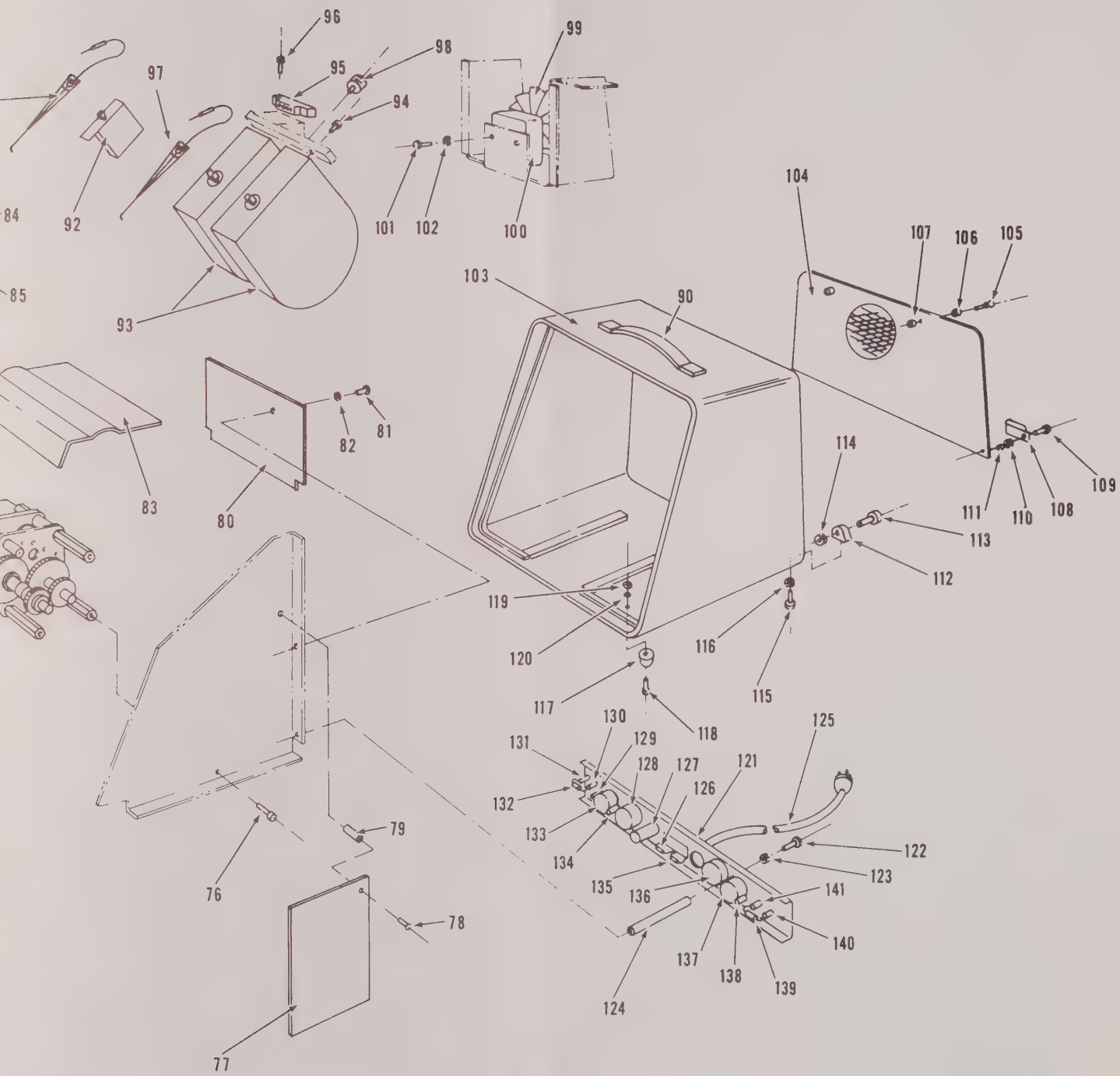


Figure 6.3 model RD 2522-20

6.2 ELECTRICAL PARTS LIST

TABLE 6.4 ELECTRICAL PARTS LIST

PART NUMBER	DESCRIPTION	REF. DESIG.	MODEL NUMBER
427344-910	Switch Assembly, V/Chart Line	A-1	All Models
341177	Motor, Chart Drive	B-1	RD 2521-20, RD 2522-20
332219	Motor, Chart Drive	B-1	RD 2521-10, RD 2521-00
227253-1	Motor, Chart Drive	B-1	RD 2522-00
121936	Motor, Fan	B-2	RD 2522-20, RD 2521-20, RD 2521-10
20-125905-103	Capacitor	C-1	All Models
		C-2	All Models
		C-303	All Models
5-130488-254	Capacitor	C-3	All Models
		C-4	All Models
5-122233-242	Capacitor	C-5	RD 2522-20, RD 2521-20, RD 2521-10, RD 2521-00
		C-7	RD 2522-00
232732	Capacitor	C-6A, C-6B	RD 2522-20, RD 2521-20, RD 2521-10
100-119526-106	Capacitor	C-7	RD 2522-20
		C-8	RD 2522-20
		C-5	RD 2522-00
		C-6	RD 2522-00
5-117264-101	Capacitor	C-101	RD 2522-20, RD 2521-20, RD 2521-10
		C-102	RD 2522-20, RD 2521-20, RD 2521-10

TABLE 6.4 ELECTRICAL PARTS LIST (Cont)

PART NUMBER	DESCRIPTION	REF. DESIG.	MODEL NUMBER
5-117264-101	Capacitor	C-201	RD 2522-00, RD 2521-00
		C-202	RD 2522-00, RD 2521-00
5-117264-681	Capacitor	C-103	RD 2522-20, RD 2521-20, RD 2521-10
		C-205	RD 2522-00, RD 2521-00
5-117264-471	Capacitor	C-104	RD 2522-20, RD 2521-20, RD 2521-10
		C-203	RD 2522-00, RD 2521-00
5-117265-332	Capacitor	C-105	RD 2522-20, RD 2521-20, RD 2521-10
		C-204	RD 2522-00, RD 2521-00
127152	Capacitor	C-301A, C-301B, C-301C	RD 2522-20, RD 2521-20, RD 2521-10
		C-302, C-304, C-306	RD 2522-00, RD 2521-00
128020-107	Capacitor	C-301	RD 2522-00, RD 2521-00
232537	Capacitor	C-302A, C-302B	RD 2522-20, RD 2521-20, RD 2521-10
10-125905-104	Capacitor	C-303-304	RD 2522-20, RD 2521-20, RD 2521-10
		C-305	RD 2522-00, RD 2521-00
128850-2	Clipper, Symmetrical	CR-1	RD 2521-00
		CR-3	RD 2522-00
128850-3	Clipper, Symmetrical	CR-1	RD 2522-20, RD 2521-20, RD 2521-10

TABLE 6.4 ELECTRICAL PARTS LIST (Cont)

PART NUMBER	DESCRIPTION	REF. DESIG.	MODEL NUMBER
130198-2	Rectifier	CR-2, CR-3	RD 2522-20
		CR-1, CR-2	RD 2522-00
130198-1	Rectifier, 1N2069	CR-301	RD 2522-20, RD 2521-20, RD 2521-10
1-127522-5	Rectifier	CR-301	RD 2522-00, RD 2521-00
232253	Semiconductor, 1N1524	CR-302	RD 2522-20, RD 2521-20, RD 2521-10
126621	Indicator, Neon	DS-1	RD 2522-20, RD 2521-20, RD 2521-10, RD 2521-00
105710-2		DS-2, DS-3	RD 2522-20
		DS-1, DS-2	RD 2522-00
102625-9	Fuse, 3AG-3A	F-1	All Models
126395-3	Post, Binding	J-1, J-2, J-3	All Models
130168	Connector, Receptacle	J-4	RD 2522-20, RD 2522-00
227665-910	Event Marker Asm, L.H.	K-1	All Models
227665-920	Event Marker Asm, R.H.	K-2	All Models
845148-142	Penmotor Assembly	M-1	All Models
126295-7	Cable, Power	P-1	All Models
232211	Transistor, 2N176	Q-1	RD 2522-20, RD 2521-20, RD 2521-10
50-117802-2504	Resistor	R-1, R-20	All Models

TABLE 6.4 ELECTRICAL PARTS LIST (Cont)

PART NUMBER	DESCRIPTION	REF. DESIG.	MODEL NUMBER
50-117802-1504	Resistor	R-2, R-19	All Models
50-117802-5003	Resistor	R-3, R-18	All Models
50-117802-2503	Resistor	R-4, R-17	All Models
50-117802-1503	Resistor	R-5, R-16	All Models
50-117802-5002	Resistor	R-6, R-15	All Models
50-117802-2502	Resistor	R-7, R-14	All Models
50-117802-1502	Resistor	R-8, R-13	All Models
50-117802-5001	Resistor	R-9, R-10, R-11, R-12	All Models
127251	Resistor, Variable w/switch	R-21, S-2	All Models
127390	Resistor, Variable	R-22A, R-22B	RD 2522-20, RD 2521-20
		R-22, R-24	RD 2521-10, RD 2521-00, RD 2522-00
19-211473-502	Resistor, Variable	R-23	All Models
1-117802-3004	Resistor	R-25	RD 2522-20, RD 2521-20, RD 2521-10, RD 2521-00
		R-31	RD 2522-00

TABLE 6.4 ELECTRICAL PARTS LIST (Cont)

PART NUMBER	DESCRIPTION	REF. DESIG.	MODEL NUMBER
126255	Resistor, Variable	R-26A, R-26B, S-5	RD 2522-20, RD 2521-20
		R-32 R-33, S-5	RD 2522-00
		R-26, R-27, S-5	RD 2521-10, RD 2521-00
5-118180-503	Resistor	R-27, R-28, R-29, R-30	RD 2522-20, RD 2522-00
5-118180-123	Resistor	R-31	RD 2522-20
		R-26	RD 2522-00
5-115557-334	Resistor	R-32	RD 2522-20
		R-25	RD 2522-00
5-115557-153	Resistor	R-101, R-102	RD 2522-20, RD 2521-20, RD 2521-10
		R-201, R-202	RD 2522-00, RD 2521-00
5-115557-152	Resistor	R-103	RD 2522-20, RD 2521-20, RD 2521-10
		R-203	RD 2522-00, RD 2521-00
1-117802-2503	Resistor	R-104, R-105	RD 2522-20, RD 2521-20, RD 2521-10
		R-204, R-205	RD 2522-00, RD 2521-00

TABLE 6.4 ELECTRICAL PARTS LIST (Cont)

PART NUMBER	DESCRIPTION	REF. DESIG.	MODEL NUMBER
1-117802-1254	Resistor	R-106, R-108, R-110, R-111	RD 2522-20, RD 2521-20, RD 2521-10
		R-206, R-208, R-210, R-211	RD 2522-00, RD 2521-00
1-117802-3503	Resistor	R-107	RD 2522-20, RD 2521-20, RD 2521-10
		R-207	RD 2522-00, RD 2521-00
1-117802-2004	Resistor	R-109, R-112	RD 2522-20, RD 2521-20, RD 2521-10
		R-209, R-212	RD 2522-00, RD 2521-00
1-117802-1003	Resistor	R-113, R-116	RD 2522-20, RD 2521-20, RD 2521-10
		R-213, R-216	RD 2522-00, RD 2521-00
5-115557-362	Resistor	R-114, R-115	RD 2522-20, RD 2521-20, RD 2521-10
		R-214, R-215	RD 2522-00, RD 2521-00
1-117802-2352	Resistor	R-117	RD 2522-20, RD 2521-20, RD 2521-10
		R-217	RD 2522-00, RD 2521-00
1-117802-1104	Resistor	R-118, R-121	RD 2522-20, RD 2521-20, RD 2521-10
		R-218, R-221	RD 2522-00, RD 2521-00

TABLE 6.4 ELECTRICAL PARTS LIST (Cont)

PART NUMBER	DESCRIPTION	REF. DESIG.	MODEL NUMBER
1-117802-5103	Resistor	R-119, R-120	RD 2522-20, RD 2521-20, RD 2521-10
		R-219, R-220	RD 2522-00, RD 2521-00
1-117802-3004	Resistor	R-122, R-123, R-132	RD 2522-20, RD 2521-20, RD 2521-10
		R-223, R-226, R-232	RD 2522-00, RD 2521-00
5-115557-104	Resistor	R-124, R-125	RD 2522-20, RD 2521-20, RD 2521-10
		R-224, R-225	RD 2522-00, RD 2521-00
5-115557-273	Resistor	R-126	RD 2522-20, RD 2521-20, RD 2521-10
		R-227	RD 2522-00, RD 2521-00
1-117802-1724	Resistor	R-127, R-130	RD 2522-20, RD 2521-20, RD 2521-10
		R-228, R-231	RD 2522-00, RD 2521-00
1-117802-4703	Resistor	R-128, R-129, R-131	RD 2522-20, RD 2521-20, RD 2521-10
		R-222, R-229, R-230	RD 2522-00, RD 2521-00
5-115559-112	Resistor	R-133	RD 2522-20, RD 2521-20, RD 2521-10
		R-233	RD 2522-00, RD 2521-00

TABLE 6.4 ELECTRICAL PARTS LIST (Cont)

PART NUMBER	DESCRIPTION	REF. DESIG.	MODEL NUMBER
5-115558-561	Resistor	R-301	RD 2522-20, RD 2521-20, RD 2521-10
129209	Resistor, Variable	R-301	RD 2522-00, RD 2521-00
5-111111-5RO	Resistor	R-302	RD 2522-20, RD 2521-20, RD 2521-10
5-115557-102	Resistor	R-303	RD 2522-20, RD 2521-20, RD 2521-10
		R-302	RD 2522-00, RD 2521-00
5-115557-330	Resistor	R-304, R-306	RD 2522-20, RD 2521-20, RD 2521-10
		R-303, R-304	RD 2522-00, RD 2521-00
5-115557-225	Resistor	R-305	RD 2522-20, RD 2521-20, RD 2521-10
		R-306	RD 2522-00, RD 2521-00
5-115557-224	Resistor	R-307	RD 2522-20, RD 2521-20, RD 2521-10
		R-305	RD 2522-00, RD 2521-00
1-117802-3302	Resistor	R-308, R-309	RD 2522-20, RD 2521-20, RD 2521-10
		R-307, R-308	RD 2522-00, RD 2521-00
1-117802-3902	Resistor	R-310	RD 2522-20, RD 2521-20, RD 2521-10
		R-309	RD 2522-00, RD 2521-00
5-115557-101	Resistor	R-311	RD 2522-20, RD 2521-20, RD 2521-10
		R-310	RD 2522-00, RD 2521-00

TABLE 6.4 ELECTRICAL PARTS LIST (Cont)

PART NUMBER	DESCRIPTION	REF. DESIG.	MODEL NUMBER
5-115558-473	Resistor	R-312	RD 2522-20, RD 2521-20, RD 2521-10
		R-311	RD 2522-00, RD 2521-00
1-117803-7502	Resistor	R-313	RD 2522-20, RD 2521-20, RD 2521-10
		R-312	RD 2522-00, RD 2521-00
1-117803-5002	Resistor	R-314	RD 2522-20, RD 2521-20, RD 2521-10
		R-313	RD 2522-00, RD 2521-00
128196	Resistor, Thermal	RT-1	All Models
227219	Switch	S-1	All Models
121068	Switch, Toggle, S.P.S.T.	S-3, S-9	RD 2522-20
		S-3, S-7	RD 2522-00
		S-3	RD 2521-20, RD 2521-10, RD 2521-00
127521	Switch, Push, S.P.D.T.	S-4	All Models
244301	Switch	1/2 S-6	RD 2522-20, RD 2521-20, RD 2521-10, RD 2521-00
		1/2 S-8	RD 2522-00
244288	Switch	1/2 S-6	RD 2522-20, RD 2521-20, RD 2521-10, RD 2521-00
		1/2 S-8	RD 2522-00
231968	Switch, Push, S.P.S.T.	S-7	RD 2522-20, RD 2521-20, RD 2521-10

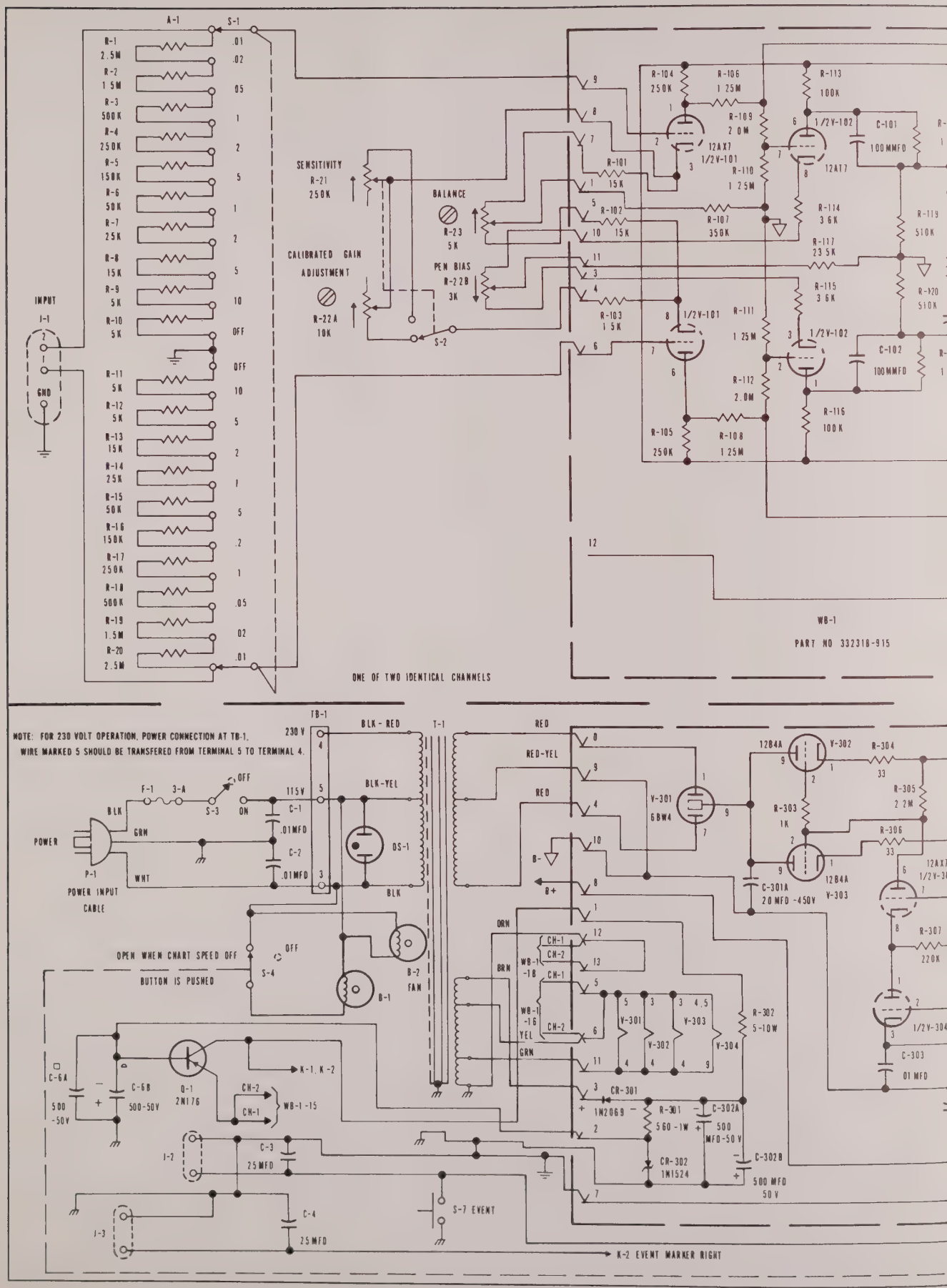
TABLE 6.4 ELECTRICAL PARTS LIST (Cont)

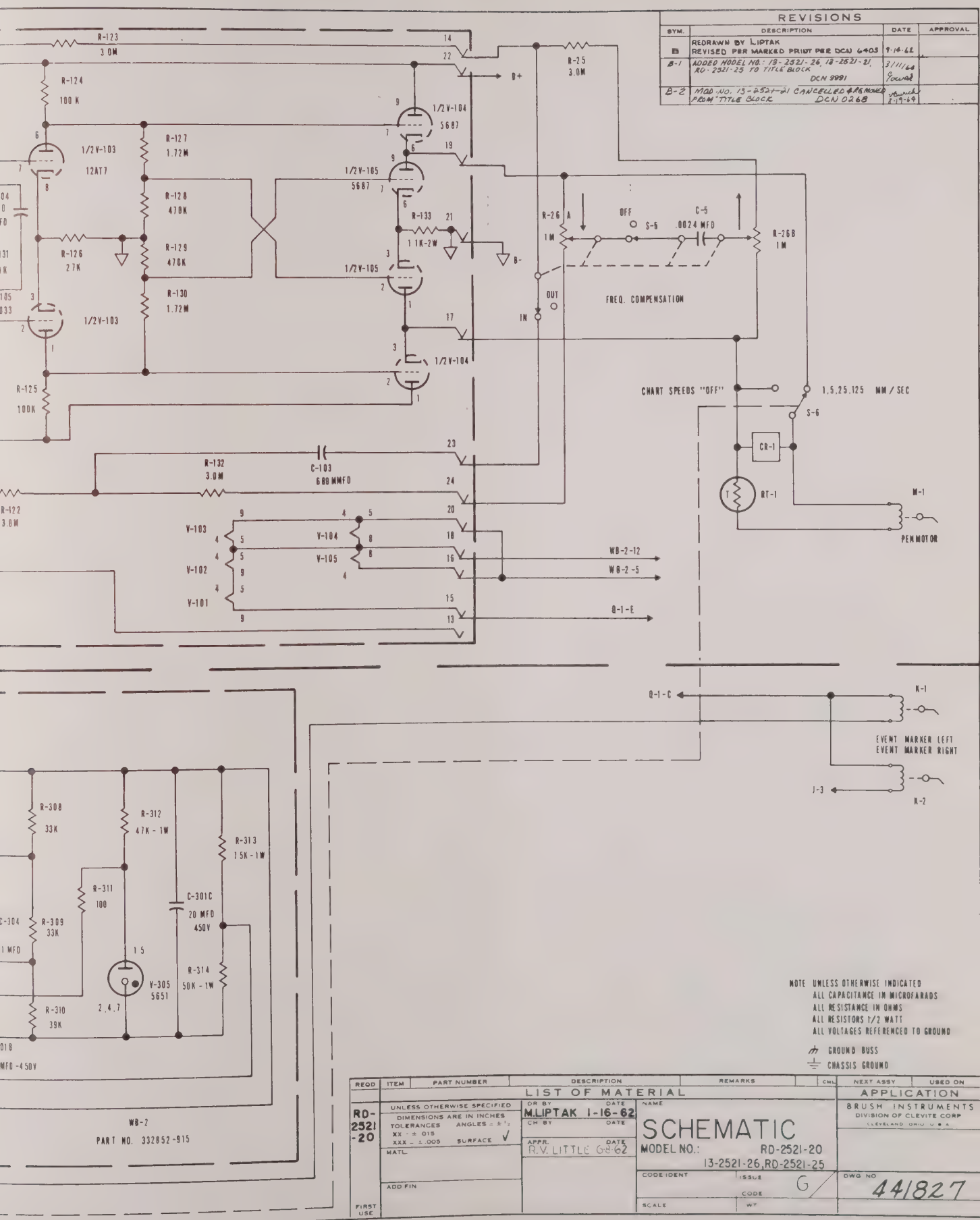
PART NUMBER	DESCRIPTION	REF. DESIG.	MODEL NUMBER
129638	Switch, Sensitive	S-8	RD 2522-20
		S-6	RD 2522-00
229283	Transformer	T-1	RD 2522-20, RD 2521-20
227396	Transformer	T-1	RD 2522-00, RD 2521-10, RD 2521-00
230176	Transformer	T-2	RD 2522-20, RD 2522-00
105982-1	Strip, Terminal	TB-1	RD 2522-20, RD 2521-20
125835	Tube, 12AX7	V-101, V-304	RD 2522-20, RD 2521-20, RD 2521-10
		V-201, V-304	RD 2522-00, RD 2521-00
125833	Tube, Selected*	V-102 V-103	Rd 2522-20, RD 2521-20, RD 2521-10
		V-202, V-203	RD 2522-00, RD 2521-00
122828	Tube, 5687	V-104, V-105	RD 2522-20, RD 2521-20, RD 2521-10
		V-204, V-205	RD 2522-00, RD 2521-00
119373	Tube, 3TF4	V-206	RD 2522-00, RD 2521-00
126997	Tube, 6BW4	V-301	All Models
124390	Tube, 12B4A	V-302, V-303	All Models
240853	Tube, 5651	V-305	All Models

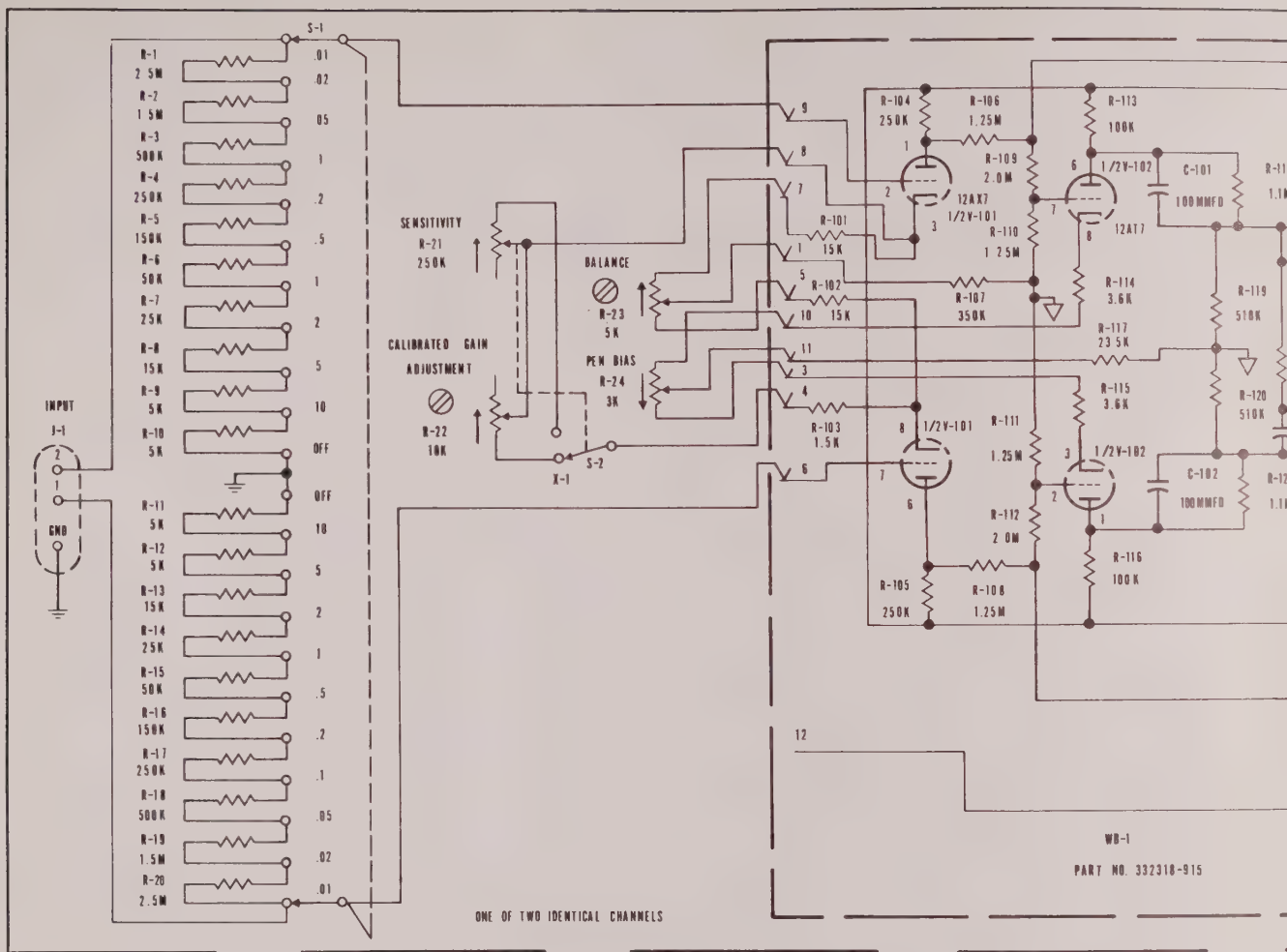
*Special, must be replaced with Brush Part No. 125833

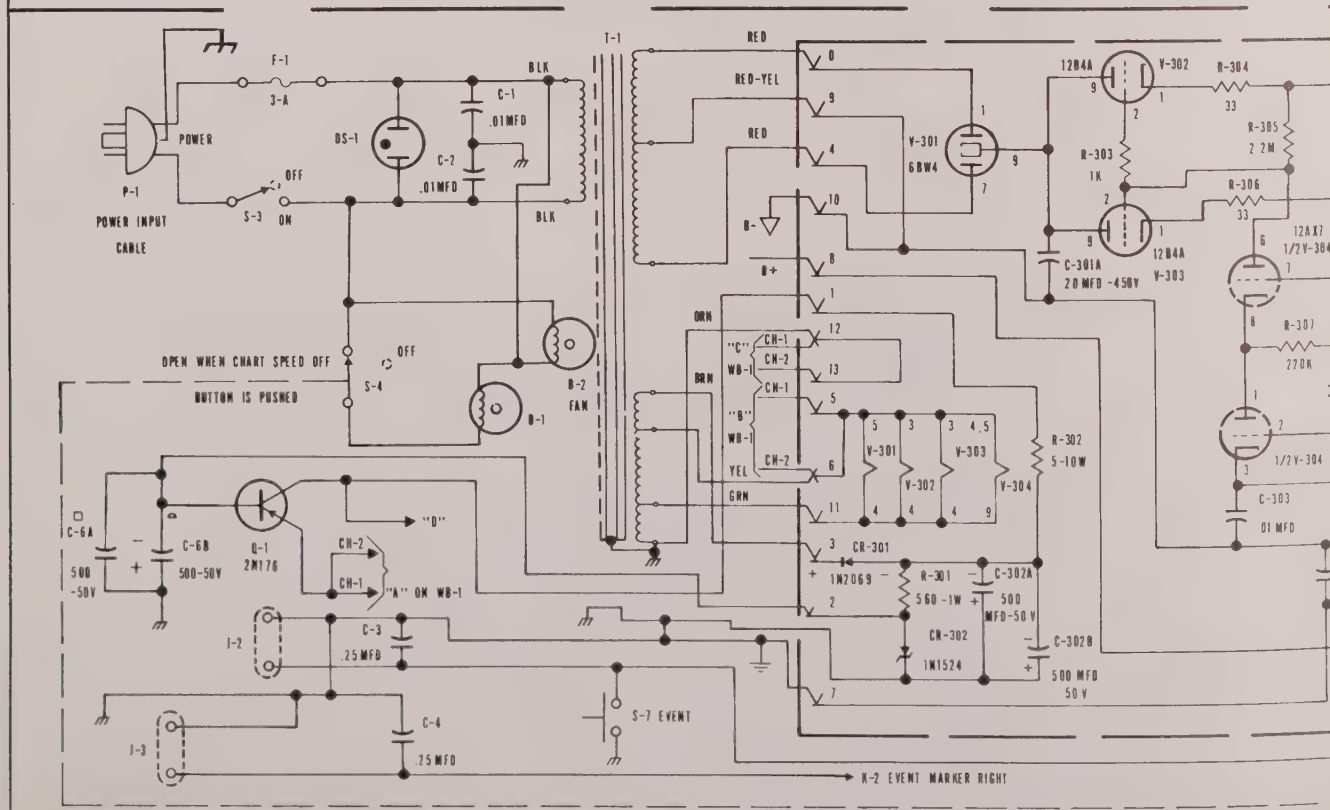
TABLE 6.4 ELECTRICAL PARTS LIST (Cont)

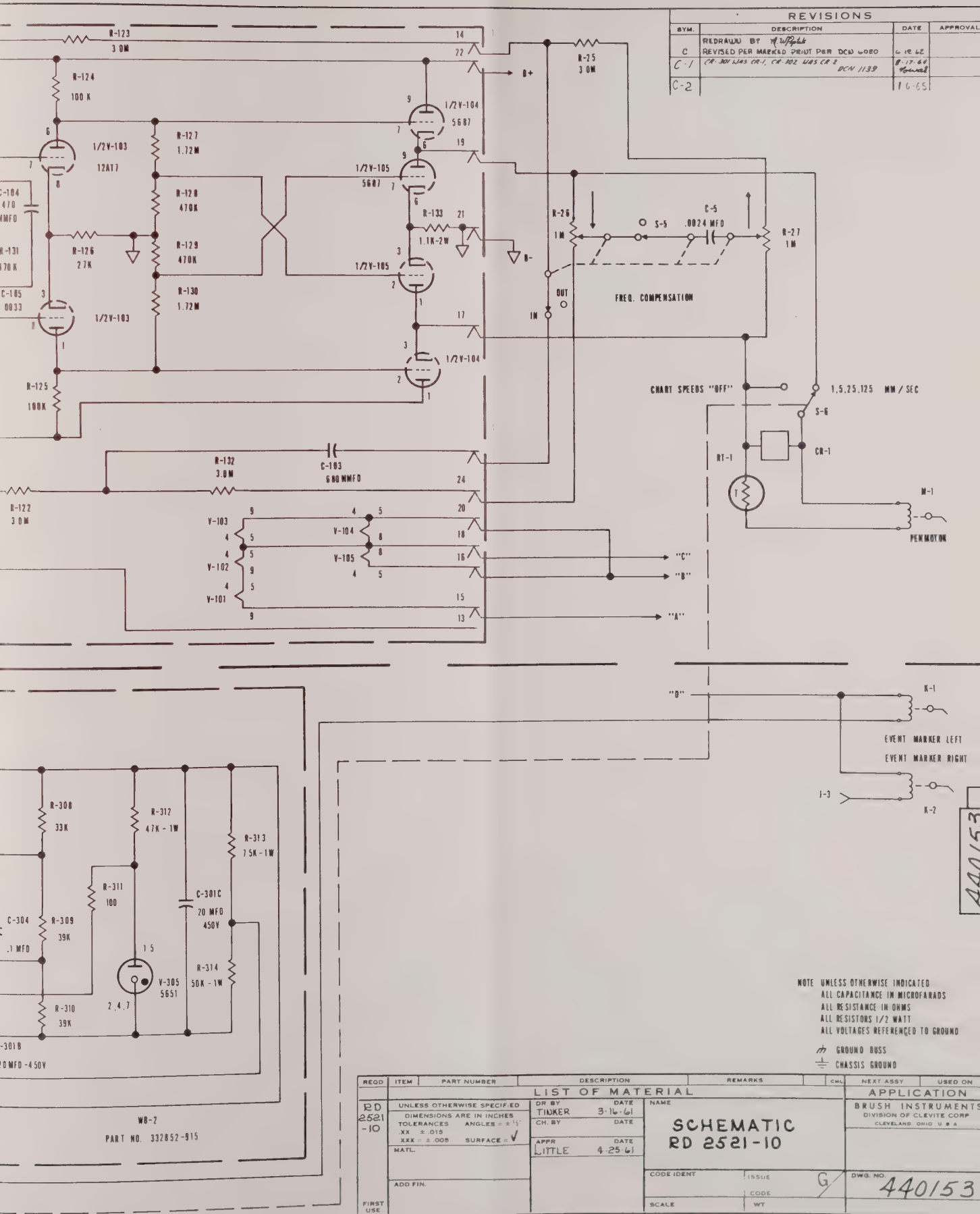
PART NUMBER	DESCRIPTION	REF. DESIG.	MODEL NUMBER
332318-915	Board Assembly, Pen Drive	WB-1	RD 2522-20, RD 2521-20, RD 2521-10
326899-920	Board Assembly, Pen Drive	WB-1	RD 2522-00, RD 2521-00
332852-915	Board Assembly, Power Supply	WB-2	RD 2522-20, RD 2521-20, RD 2521-10
327395-915	Board Assembly, Power Supply	WB-2	RD 2522-00, RD 2521-00
119365	Fuseholder	XF-1	All Models


A-1
S-1
R-1 2.5M
R-2 1.5M
R-3 500K
R-4 250K
R-5 150K
R-6 50K
R-7 25K
R-8 15K
R-9 5K
R-10 5K
R-11 5K
R-12 5K
R-13 15K
R-14 25K
R-15 50K
R-16 150K
R-17 250K
R-18 500K
R-19 1.5M
R-20 2.5M
.01
.02
.05
1
2
5
10
OFF
INPUT
J-1
GND
SENSITIVITY
R-21 250K
BALANCE
R-23 5K
CALIBRATED GAIN ADJUSTMENT
R-22A 10K
PEN BIAS
R-22B 3K
S-2
R-101 15K
R-102 15K
R-103 1.5K
R-104 250K
R-105 250K
R-106 1.25M
R-107 350K
R-108 1.25M
R-109 2.0M
R-110 1.25M
R-111 1.25M
R-112 2.0M
R-113 100K
R-114 3.6K
R-115 3.6K
R-116 100K
R-117 23.5K
R-119 510K
R-120 510K
12AX7 1/2V-101
1/2V-102
12AT7
C-101 100MMFD
C-102 100MMFD
WB-1
PART NO 332318-915
ONE OF TWO IDENTICAL CHANNELS
NOTE: FOR 230 VOLT OPERATION, POWER CONNECTION AT TB-1, WIRE MARKED 5 SHOULD BE TRANSFERED FROM TERMINAL 5 TO TERMINAL 4.
TB-1
230 V
115V
BLK - RED
BLK-YEL
BLK
GRN
WHT
POWER
P-1
POWER INPUT CABLE
F-1
3-A
S-3
OFF
ON
C-1 .01MFD
C-2 .01MFD
DS-1
T-1
RED
RED-YEL
B-
B+
V-301 6BW4
V-302 12B4A
V-303 12B4A
R-302 5-10W
R-303 1K
R-304 33
R-305 2.2M
R-306 33
R-307 220K
C-301A 20 MFD -450V
C-303 .01 MFD
1/2V-304
ORN
BRN
YEL
GRN
WB-1 -18
WB-1 -16
CH-1
CH-2
V-304
CR-301 1N2069
R-301 560 -1W
C-302A 500 MFD-50 V
CR-302 1N1524
C-302B 500 MFD 50 V
OPEN WHEN CHART SPEED OFF BUTTON IS PUSHED
S-4
B-1
B-2 FAN
C-6A 500 -50V
C-6B 500-50V
Q-1 2N176
K-1, K-2
WB-1 -15
J-2
C-3 25MFD
J-3
C-4 25MFD
S-7 EVENT
K-2 EVENT MARKER RIGHT


REVISIONS
SYM. DESCRIPTION DATE APPROVAL
B REDRAWN BY LIPTAK REVISED PER MARKED PRINT PER DCN 6405 9-16-62
B-1 ADDED MODEL NO.: 13-2521-26, 13-2521-21, RD-2521-25 TO TITLE BLOCK DCN 9991 3/11/64 Jowett
B-2 MOD NO. 13-2521-01 CANCELLED & REMOVED FROM TITLE BLOCK DCN 0268 Jowett 2-19-69
R-123 3.0M
R-124 100 K
R-125 100K
R-126 27K
R-127 1.72M
R-128 470K
R-129 470K
R-130 1.72M
R-132 3.0M
R-133 1.1K-2W
R-25 3.0M
R-26 A 1M
R-26B 1M
C-5 .0024 MFD
C-103 680 MMFD
1/2V-103 12AT7
1/2V-104 5687
1/2V-105 5687
V-101
V-102
V-103
V-104
V-105
B+
B-
OFF
S-6
OUT
IN
FREQ. COMPENSATION
CHART SPEEDS "OFF"
1.5,25,125 MM/SEC
CR-1
RT-1
M-1
PEN MOTOR
WB-2-12
WB-2-5
Q-1-E
Q-1-C
K-1
EVENT MARKER LEFT
EVENT MARKER RIGHT
J-3
K-2
R-308 33K
R-309 33K
R-310 39K
R-311 100
R-312 47K - 1W
R-313 7.5K - 1W
R-314 50K - 1W
C-301C 20 MFD 450V
V-305 5651
WB-2
PART NO. 332852-915
NOTE UNLESS OTHERWISE INDICATED
ALL CAPACITANCE IN MICROFARADS
ALL RESISTANCE IN OHMS
ALL RESISTORS 1/2 WATT
ALL VOLTAGES REFERENCED TO GROUND
GROUND BUSS
CHASSIS GROUND
LIST OF MATERIAL
REQD ITEM PART NUMBER DESCRIPTION REMARKS CML NEXT ASSY USED ON
RD-2521-20
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ANGLES ± ½
XX - ± .015
XXX - ± .005
SURFACE √
MATL
ADD FIN
FIRST USE
DR BY M.LIPTAK 1-16-62
CH BY
APPR. R.V. LITTLE 6-8-62
NAME SCHEMATIC
MODEL NO.: RD-2521-20
13-2521-26, RD-2521-25
CODE IDENT
ISSUE G
CODE
SCALE
WT
APPLICATION
BRUSH INSTRUMENTS
DIVISION OF CLEVITE CORP
CLEVELAND OHIO U.S.A.
DWG NO 441827


INPUT
J-1
GND
S-1
R-1 2.5M
R-2 1.5M
R-3 500K
R-4 250K
R-5 150K
R-6 50K
R-7 25K
R-8 15K
R-9 5K
R-10 5K
R-11 5K
R-12 5K
R-13 15K
R-14 25K
R-15 50K
R-16 150K
R-17 250K
R-18 500K
R-19 1.5M
R-20 2.5M
.01
.02
.05
1
.2
.5
1
2
5
10
OFF
OFF
10
5
2
1
.5
.2
.1
.05
.02
.01
SENSITIVITY R-21 250K
BALANCE R-23 5K
CALIBRATED GAIN ADJUSTMENT R-22 10K
PEN BIAS R-24 3K
X-1
S-2
R-101 15K
R-102 15K
R-103 1.5K
R-104 250K
R-105 250K
R-106 1.25M
R-107 350K
R-108 1.25M
R-109 2.0M
R-110 1.25M
R-111 1.25M
R-112 2.0M
R-113 100K
R-114 3.6K
R-115 3.6K
R-116 100K
R-117 23.5K
R-119 510K
R-120 510K
12AX7 1/2V-101
1/2V-101
1/2V-102
12AT7
C-101 100MMFD
C-102 100MMFD
12
WB-1
PART NO. 332318-915
ONE OF TWO IDENTICAL CHANNELS


F-1
3-A
POWER
P-1
POWER INPUT CABLE
OFF
S-3
ON
DS-1
C-1 .01MFD
C-2 .01MFD
BLK
BLK
T-1
RED
RED-YEL
RED
B-
B+
V-301 6BW4
12B4A
V-302
R-304 33
R-305 2.2M
R-303 1K
R-306 33
C-301A 20MFD -450V
V-303
12AX7 1/2V-304
R-307 220K
1/2V-304
C-303 01 MFD
OPEN WHEN CHART SPEED OFF BUTTON IS PUSHED
OFF
S-4
B-2 FAN
B-1
ORN
BRN
YEL
GRN
"C" WB-1
"B" WB-1
CH-1
CH-2
V-301
V-302
V-303
V-304
R-302 5-10W
C-6A 500 -50V
C-6B 500-50V
Q-1 2N176
"D"
"A" ON WB-1
CR-301 1N2069
R-301 560 -1W
C-302A 500 MFD-50V
CR-302 1N1524
C-302B 500 MFD 50V
J-2
C-3 .25MFD
J-3
C-4 .25MFD
S-7 EVENT
K-2 EVENT MARKER RIGHT



NOTE UNLESS OTHERWISE INDICATED
ALL CAPACITANCE IN MICROFARADS
ALL RESISTANCE IN OHMS
ALL RESISTORS 1/2 WATT
ALL VOLTAGES REFERENCED TO GROUND

⏚ GROUND BUSS
⏚ CHASSIS GROUND

REQD	ITEM	PART NUMBER	DESCRIPTION	REMARKS	CHL	NEXT ASSY	USED ON

LIST OF MATERIAL

RD 2521-10

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ANGLES = ±½°
.XX ± .015
.XXX = ±.005 SURFACE = √
MATL.
ADD FIN.
FIRST USE

DR BY TINKER DATE 3-16-61
CH. BY DATE
APPR LITTLE DATE 4-25-61

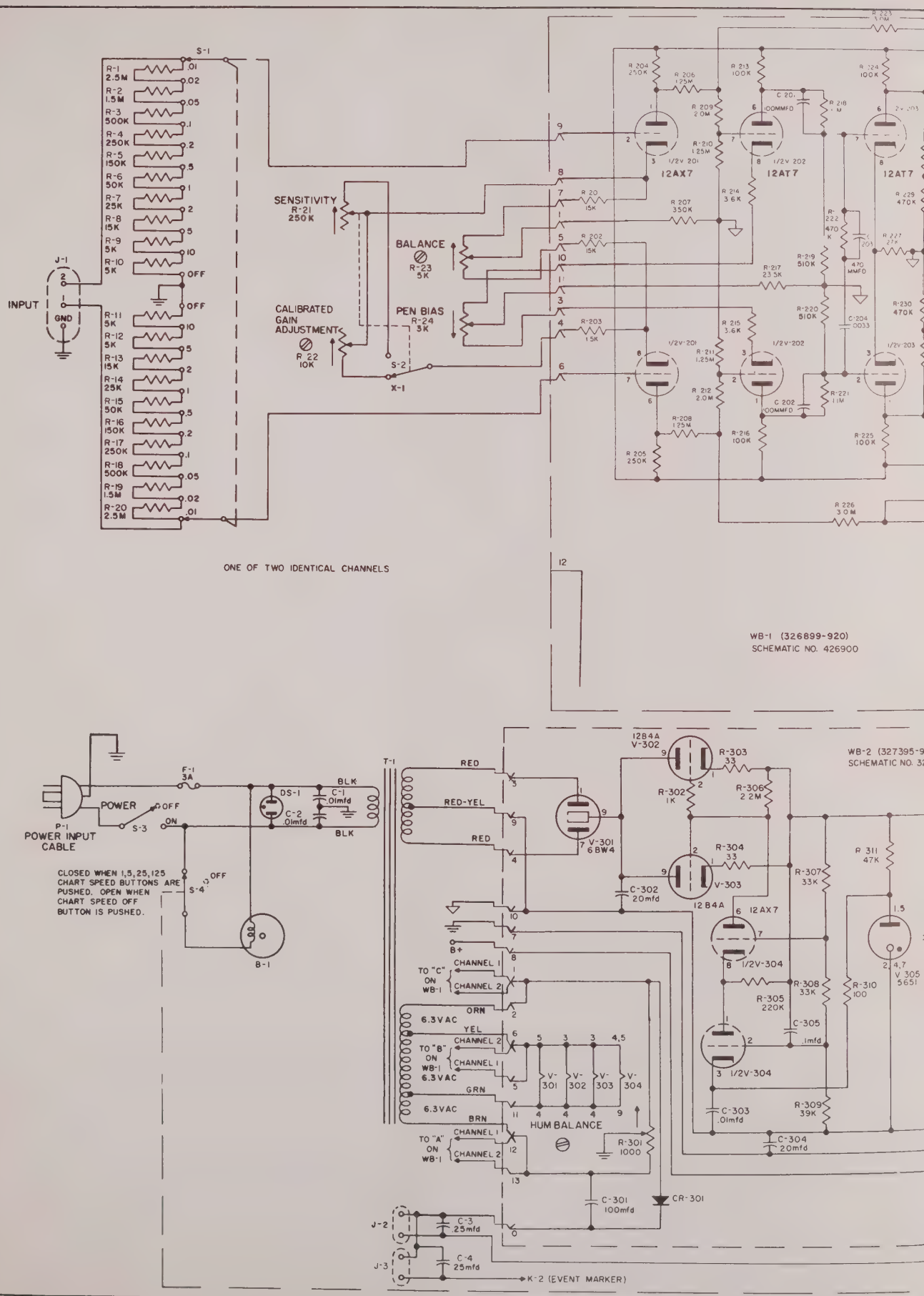
NAME SCHEMATIC RD 2521-10

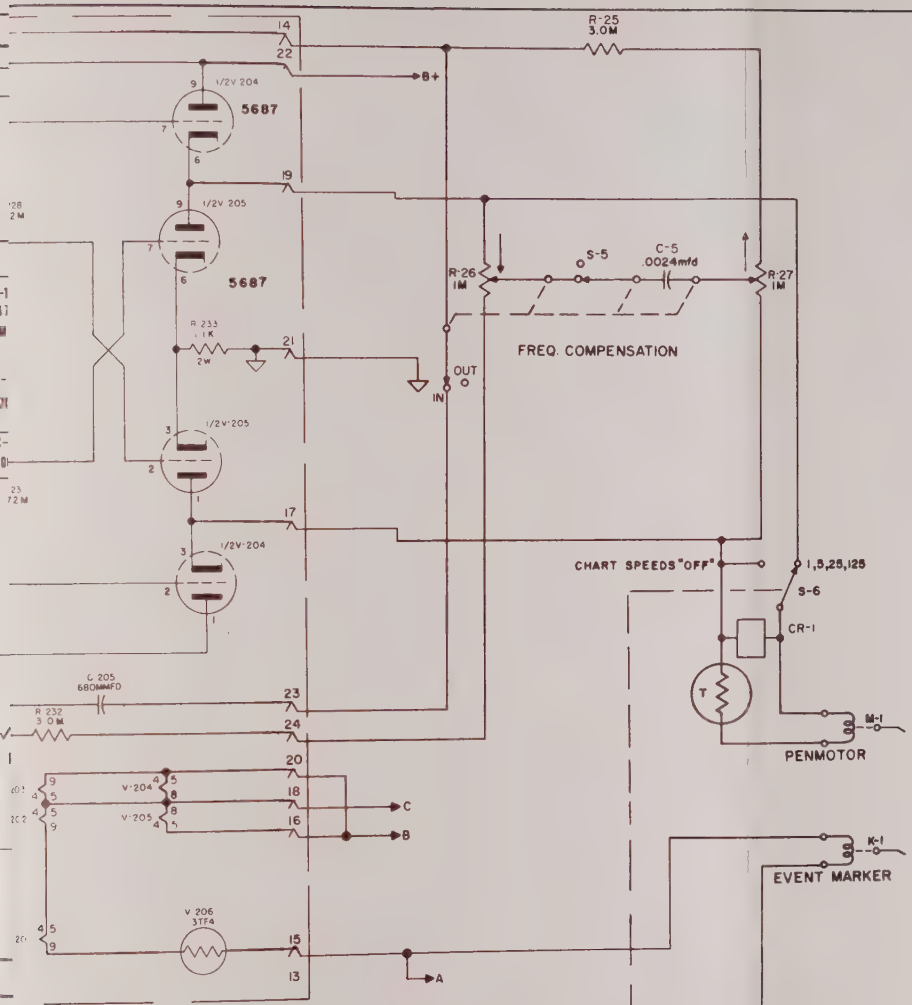
CODE IDENT ISSUE G
CODE
SCALE WT

APPLICATION
BRUSH INSTRUMENTS
DIVISION OF CLEVITE CORP
CLEVELAND OHIO U S A

DWG. NO. 440153

440153


S-1
R-1 2.5M
R-2 1.5M
R-3 500K
R-4 250K
R-5 150K
R-6 50K
R-7 25K
R-8 15K
R-9 5K
R-10 5K
R-11 5K
R-12 5K
R-13 15K
R-14 25K
R-15 50K
R-16 150K
R-17 250K
R-18 500K
R-19 1.5M
R-20 2.5M
.01
.02
.05
.1
.2
.5
1
2
5
10
OFF
J-1
INPUT
GND
SENSITIVITY R-21 250K
BALANCE R-23 5K
CALIBRATED GAIN ADJUSTMENT R-22 10K
PEN BIAS R-24 3K
S-2
X-1
12AX7
12AT7
ONE OF TWO IDENTICAL CHANNELS
WB-1 (326899-920)
SCHEMATIC NO. 426900
POWER INPUT CABLE
P-1
F-1 3A
POWER
S-3
DS-1
C-1 .01mfd
C-2 .01mfd
BLK
CLOSED WHEN 1,5,25,125 CHART SPEED BUTTONS ARE PUSHED. OPEN WHEN CHART SPEED OFF BUTTON IS PUSHED.
S-4
B-1
T-1
RED
RED-YEL
V-301 6BW4
1284A V-302
V-303
12B4A
12AX7
R-303 33
R-302 1K
R-306 2.2M
R-304 33
C-302 20mfd
B+
CHANNEL 1
CHANNEL 2
TO "C" ON WB-1
TO "B" ON WB-1
TO "A" ON WB-1
ORN
YEL
GRN
BRN
6.3VAC
V-301
V-302
V-303
V-304
HUM BALANCE
R-301 1000
C-301 100mfd
CR-301
J-2
J-3
C-3 .25mfd
C-4 .25mfd
K-2 (EVENT MARKER)
R-307 33K
R-308 33K
R-309 39K
R-310 100
R-305 220K
C-305 .1mfd
C-303 .01mfd
C-304 20mfd
R 311 47K
1/2V-304
WB-2 (327395-9
SCHEMATIC NO. 32



ALL RESISTORS 1/2WATT UNLESS
OTHERWISE INDICATED

R-312
75K

R-313
50K

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL
K-1	DELETED MOTOR CAPACITANCE		
K-2	DELETED CIRCUITRY IN YL-152 & YL-142 BLOCKS		
K-3	DELETED COMPONENT TABULATED PARTS LIST		
K-4	RENUMBERED ELECTRICAL COMPONENTS		
K-5	LABELED FRONT PANEL CONTROLS DCN 3683	1-11-61	
L-1	WB-1 WAS (332318-915) DCN 3990	3-27-61	
L-2		1965	

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REQD	ITEM	PART NUMBER	DESCRIPTION	REMARKS	CML	NEXT ASSY	USED ON
			LIST OF MATERIAL			APPLICATION	

RD 2521-00

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ANGLES = ± ½°
XX ± .015
XXX = ± .005 SURFACE = √

MATL.

ADD FIN.

FIRST USE

DR. BY LINKER DATE 12-28-60
CH BY DATE
APPR DATE
REDRAWN DCN 3683 E.H. 1-11-61

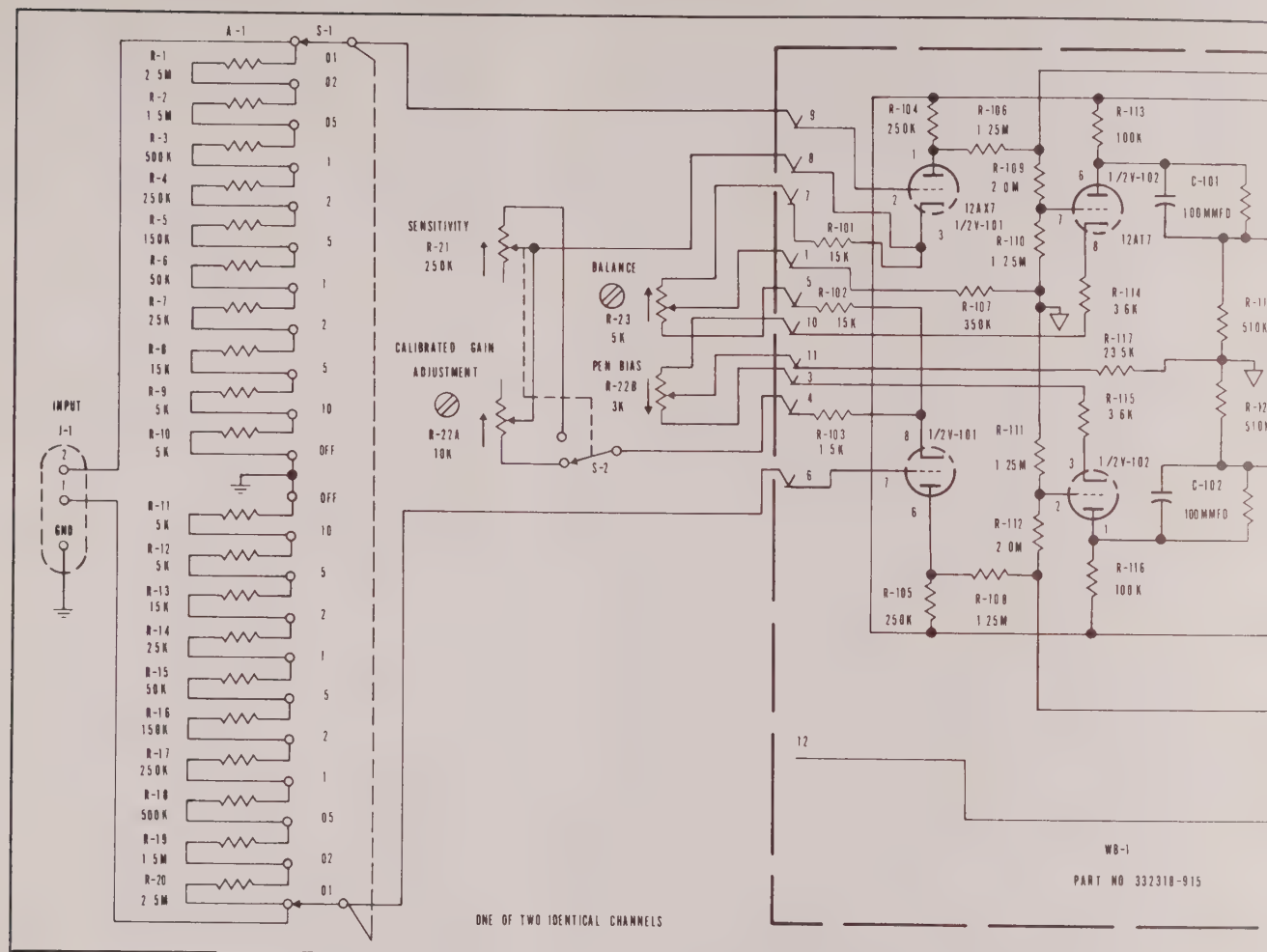
NAME SCHEMATIC
RD 2521-00

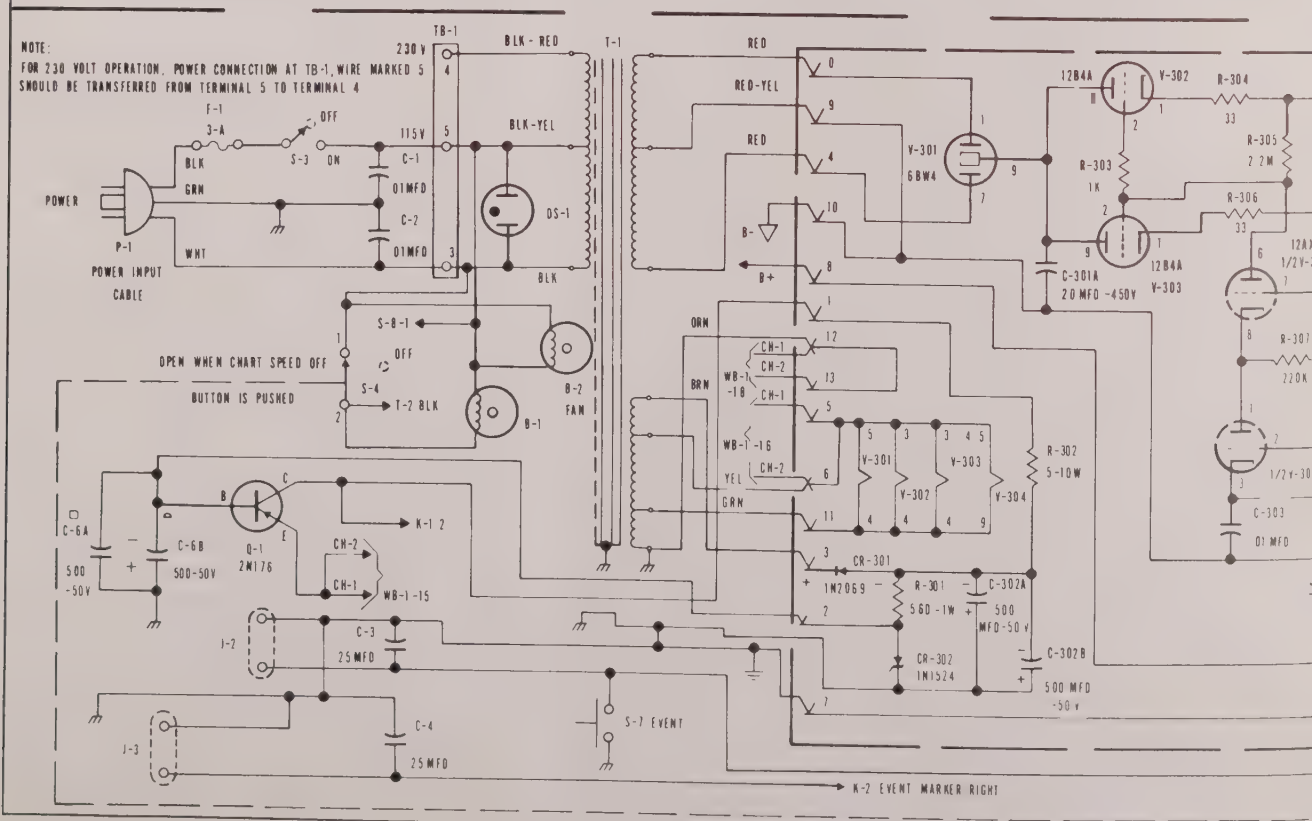
BRUSH INSTRUMENTS
DIVISION OF CLEVITE CORP.
CLEVELAND OHIO U.S.A.

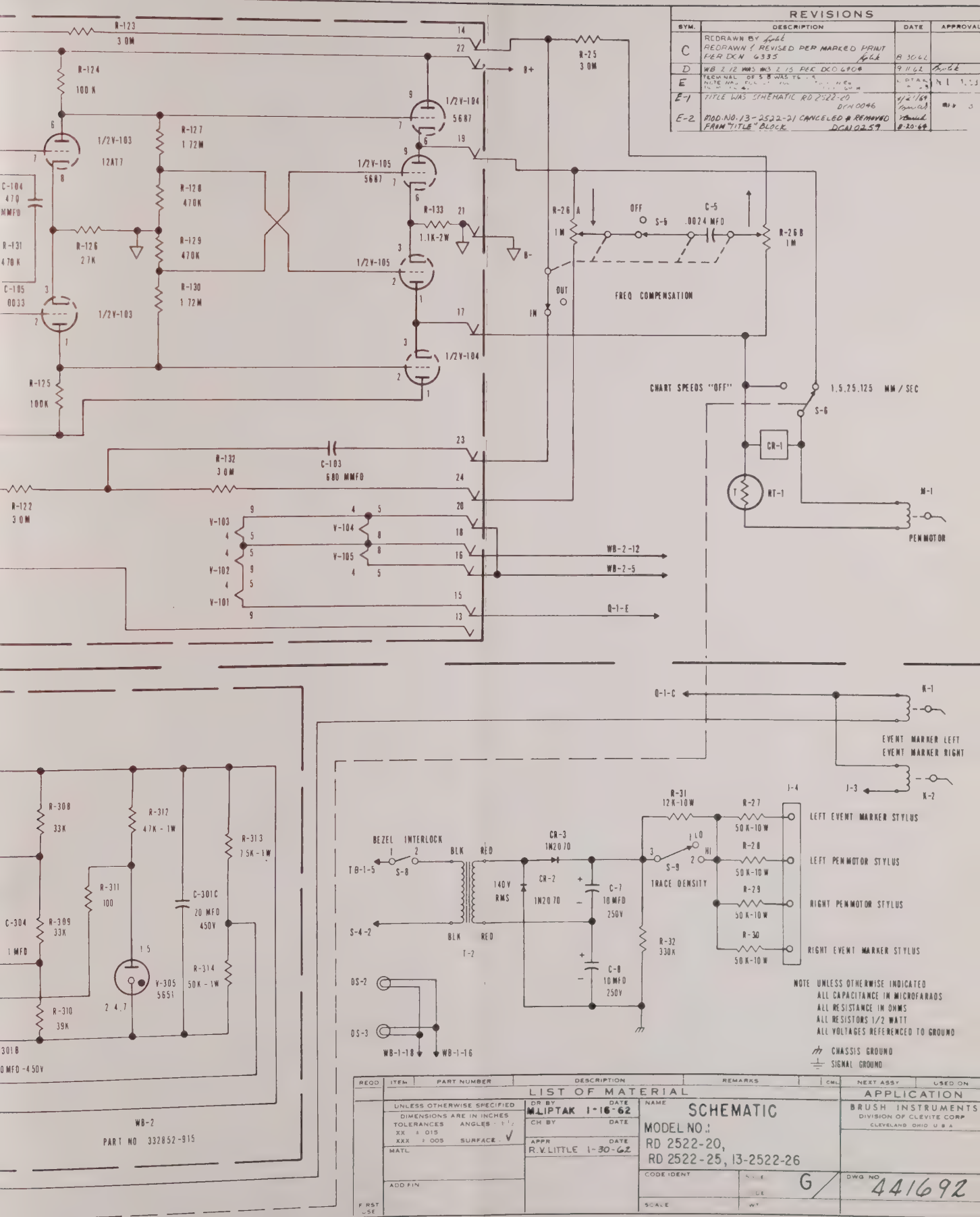
CODE IDENT

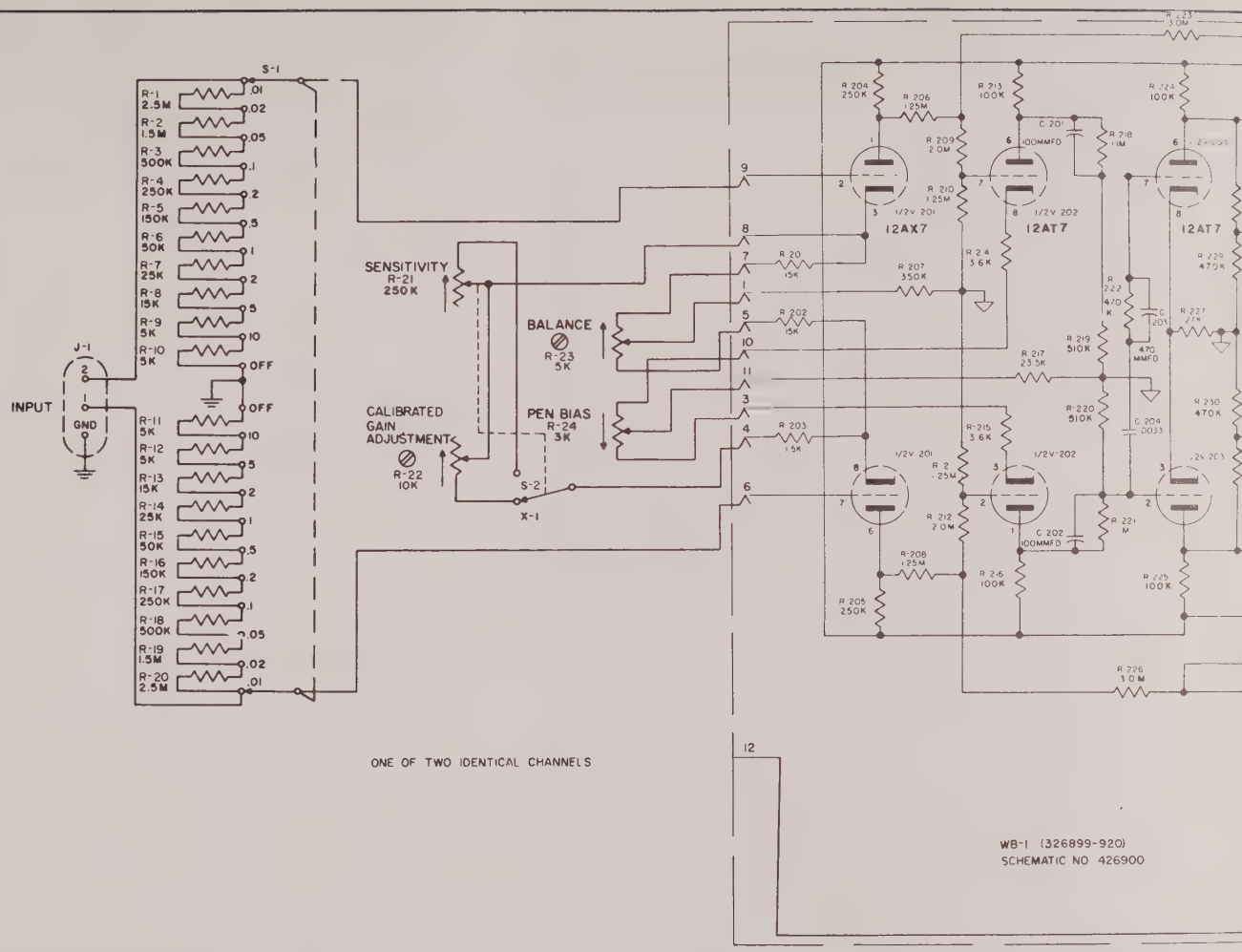
DWG NO 427378

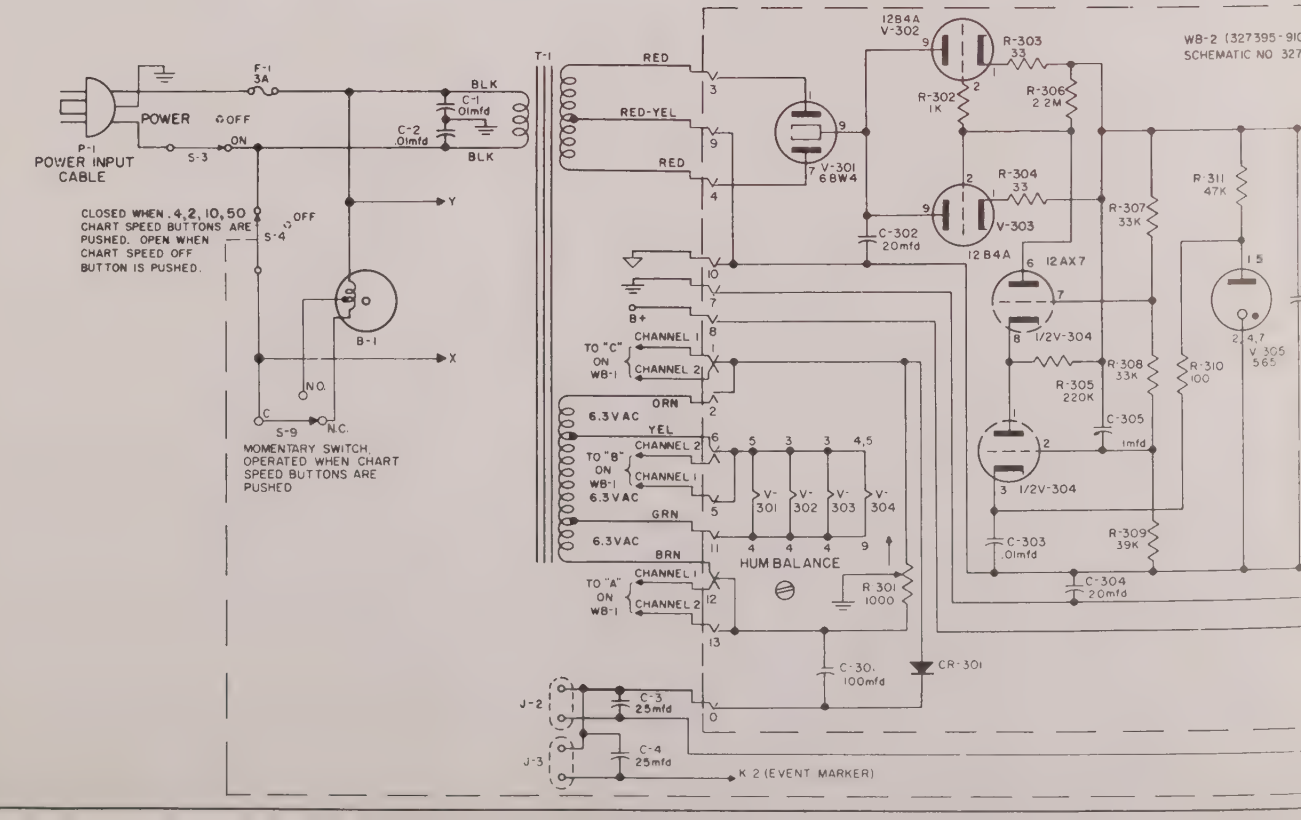
SCALE WT

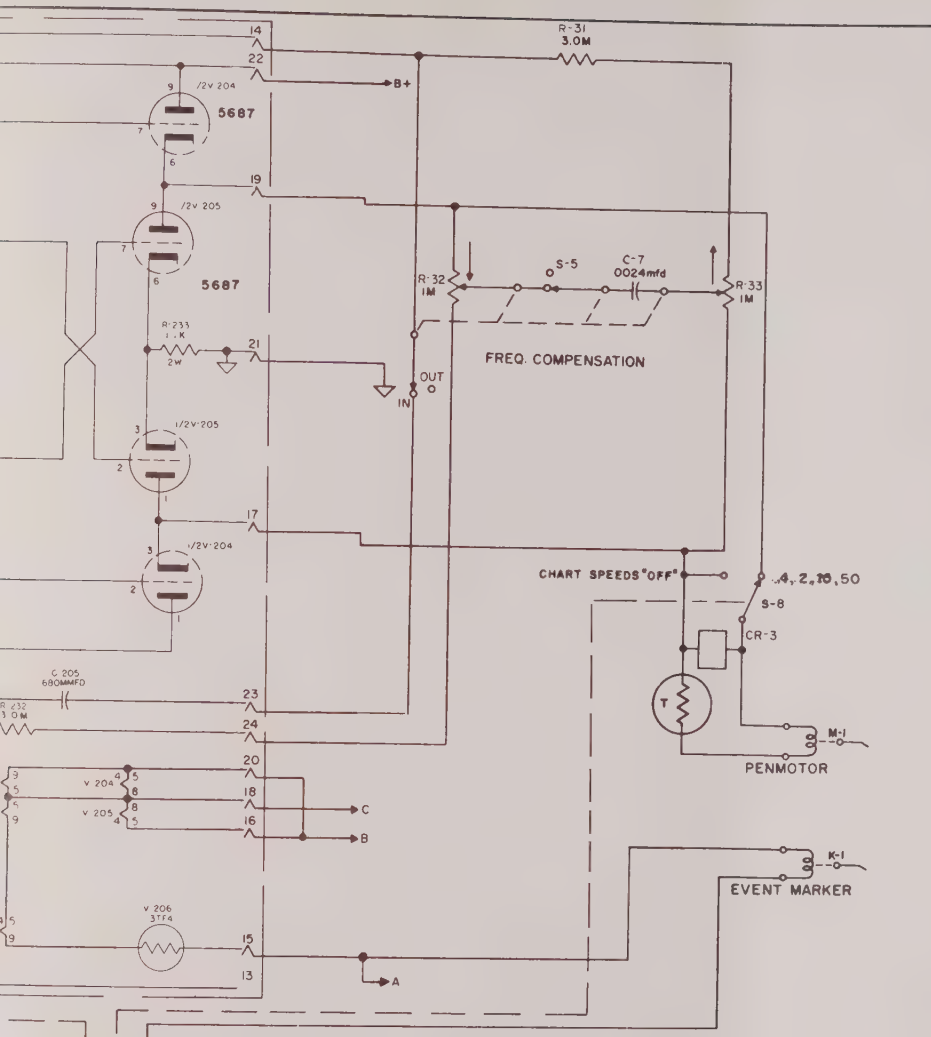

A-1
S-1
R-1 2.5M
R-2 1.5M
R-3 500K
R-4 250K
R-5 150K
R-6 50K
R-7 25K
R-8 15K
R-9 5K
R-10 5K
R-11 5K
R-12 5K
R-13 15K
R-14 25K
R-15 50K
R-16 150K
R-17 250K
R-18 500K
R-19 1.5M
R-20 2.5M
01
02
05
1
2
5
1
2
5
10
OFF
OFF
10
5
2
1
5
2
1
05
02
01
INPUT
J-1
GND
SENSITIVITY
R-21 250K
BALANCE
R-23 5K
CALIBRATED GAIN ADJUSTMENT
R-22A 10K
PEN BIAS
R-22B 3K
S-2
R-101 15K
R-102 15K
R-103 1.5K
R-104 250K
R-105 250K
R-106 1.25M
R-107 350K
R-108 1.25M
R-109 2.0M
R-110 1.25M
R-111 1.25M
R-112 2.0M
R-113 100K
R-114 3.6K
R-115 3.6K
R-116 100K
R-117 23.5K
12AX7 1/2V-101
1/2V-102
12AT7
1/2V-101
1/2V-102
C-101 100MMFD
C-102 100MMFD
WB-1
PART NO 332318-915
ONE OF TWO IDENTICAL CHANNELS

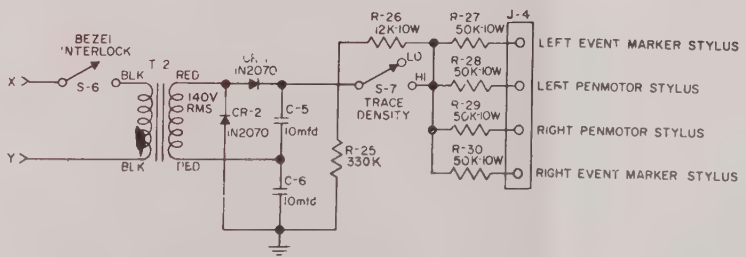

NOTE:
FOR 230 VOLT OPERATION, POWER CONNECTION AT TB-1, WIRE MARKED 5 SHOULD BE TRANSFERRED FROM TERMINAL 5 TO TERMINAL 4
TB-1
230 V
115 V
BLK - RED
BLK - YEL
T-1
F-1
3-A
S-3
OFF
ON
BLK
GRN
WHT
POWER
P-1
POWER INPUT CABLE
C-1 .01MFD
C-2 .01MFD
DS-1
BLK
S-8-1
OPEN WHEN CHART SPEED OFF BUTTON IS PUSHED
S-4
T-2 BLK
B-1
B-2 FAN
C-6A 500 -50V
C-6B 500-50V
Q-1 2N176
K-1 2
CH-2
CH-1
WB-1 -15
J-2
C-3 25MFD
J-3
C-4 25MFD
S-7 EVENT
K-2 EVENT MARKER RIGHT
RED
RED-YEL
RED
B-
B+
ORN
BRN
GRN
YEL
WB-1 -18
WB-1 -16
CH-1
CH-2
V-301 6BW4
V-301
V-302
V-303
V-304
R-302 5-10W
CR-301 1M2069
R-301 560 -1W
C-302A 500 MFD-50 V
CR-302 1N1524
C-302B 500 MFD -50 V
12B4A
V-302
R-304 33
R-305 2.2M
R-303 1K
R-306 33
C-301A 20 MFD -450V
12B4A
V-303
R-307 220K
C-303 .01 MFD

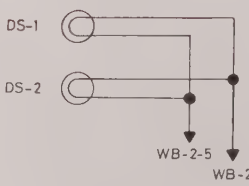

REVISIONS
SYM. DESCRIPTION DATE APPROVAL
C REDRAWN BY Lytle REDRAWN & REVISED PER MARKED PRINT PER DCN 6335 Lytle 8 30 62
D WB 2 12 WAS #3 2 13 PER DCO 6906 9 11 62 Lytle
E TERMINAL OF S-8 WAS T6-9 NOTE WAS ... DCN 0046
E-1 TITLE WAS SCHEMATIC RD 2522-20 4/2/69
E-2 MOD NO. 13-2522-21 CANCELED & REMOVED FROM "TITLE" BLOCK DCN 0259 8-20-69
R-123 3 0M
R-124 100 K
R-125 100K
R-126 2 7K
R-127 1 72M
R-128 470K
R-129 470K
R-130 1 72M
R-131 470 K
R-132 3 0M
R-133 1.1K-2W
R-122 3 0M
R-25 3 0M
R-26 A 1M
R-26 B 1M
C-104 470 MMFD
C-105 0033
C-103 680 MMFD
C-5 .0024 MFD
S-6
OFF
1/2V-103 12AT7
1/2V-104 5687
1/2V-105 5687
B+
B-
IN
OUT
FREQ COMPENSATION
CHART SPEEDS "OFF"
1.5.25.125 MM / SEC
CR-1
RT-1
M-1
PEN MOTOR
V-101
V-102
V-103
V-104
V-105
WB-2-12
WB-2-5
Q-1-E
Q-1-C
K-1
EVENT MARKER LEFT
EVENT MARKER RIGHT
K-2
J-4
J-3
R-308 33K
R-309 33K
R-310 39K
R-311 100
R-312 47K - 1W
R-313 7 5K - 1W
R-314 50K - 1W
C-304 1 MFD
C-301C 20 MFD 450V
C-301B 0 MFD - 450V
V-305 5651
WB-2
PART NO 332852-915
BEZEL INTERLOCK
S-8
TB-1-5
S-4-2
T-2
140 V RMS
CR-2 1N2070
CR-3 1N2070
C-7 10 MFD 250V
C-8 10 MFD 250V
R-31 12K-10W
R-32 330K
S-9
TRACE DENSITY
LO
HI
R-27 50K-10W
R-28 50K-10W
R-29 50K-10W
R-30 50K-10W
LEFT EVENT MARKER STYLUS
LEFT PENMOTOR STYLUS
RIGHT PENMOTOR STYLUS
RIGHT EVENT MARKER STYLUS
DS-2
DS-3
WB-1-18
WB-1-16
NOTE UNLESS OTHERWISE INDICATED
ALL CAPACITANCE IN MICROFARADS
ALL RESISTANCE IN OHMS
ALL RESISTORS 1/2 WATT
ALL VOLTAGES REFERENCED TO GROUND
CHASSIS GROUND
SIGNAL GROUND
REQD ITEM PART NUMBER DESCRIPTION REMARKS CHG NEXT ASSY USED ON
LIST OF MATERIAL
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ANGLES ± 1/2
XX ± 015
XXX ± 005
SURFACE √
MATL
ADD FIN
DR BY MLIPTAK 1-16-62
CH BY
APPR R.V.LITTLE 1-30-62
NAME SCHEMATIC
MODEL NO.: RD 2522-20, RD 2522-25, 13-2522-26
CODE IDENT G
SCALE
APPLICATION
BRUSH INSTRUMENTS
DIVISION OF CLEVITE CORP
CLEVELAND OHIO U S A
DWG NO 441692


S-1
R-1 2.5M .01
R-2 1.5M .02
R-3 500K .05
R-4 250K .1
R-5 150K .2
R-6 50K .5
R-7 25K 1
R-8 15K 2
R-9 5K 5
R-10 5K 10
OFF
OFF
R-11 5K 10
R-12 5K 5
R-13 15K 2
R-14 25K 1
R-15 50K .5
R-16 150K .2
R-17 250K .1
R-18 500K .05
R-19 1.5M .02
R-20 2.5M .01
J-1
INPUT
GND
SENSITIVITY R-21 250K
BALANCE R-23 5K
CALIBRATED GAIN ADJUSTMENT R-22 10K
PEN BIAS R-24 3K
S-2
X-1
12AX7
12AT7
12AT7
ONE OF TWO IDENTICAL CHANNELS
WB-1 (326899-920)
SCHEMATIC NO 426900


F-1 3A
POWER
OFF
ON
S-3
P-1
POWER INPUT CABLE
BLK
C-1 .01mfd
C-2 .01mfd
BLK
CLOSED WHEN 4, 2, 10, 50 CHART SPEED BUTTONS ARE PUSHED. OPEN WHEN CHART SPEED OFF BUTTON IS PUSHED.
S-4
OFF
B-1
Y
X
N.O.
C
N.C.
S-9
MOMENTARY SWITCH. OPERATED WHEN CHART SPEED BUTTONS ARE PUSHED
T-1
RED
RED-YEL
RED
ORN
6.3VAC
YEL
GRN
6.3VAC
BRN
TO "C" ON WB-1
TO "B" ON WB-1
TO "A" ON WB-1
CHANNEL 1
CHANNEL 2
12B4A V-302
R-303 33
R-302 1K
R-306 2.2M
V-301 6BW4
R-304 33
V-303 12B4A
C-302 20mfd
12AX7
1/2V-304
R-307 33K
R-311 47K
R-308 33K
R-310 100
R-305 220K
C-305 1mfd
V-305 5Y3
C-303 .01mfd
R-309 39K
C-304 .20mfd
B+
V-301
V-302
V-303
V-304
HUM BALANCE
R 301 1000
C-30 100mfd
CR-301
J-2
J-3
C-3 25mfd
C-4 25mfd
K 2 (EVENT MARKER)
WB-2 (327395-910
SCHEMATIC NO 327







NOTE:
ALL RESISTORS 1/2 WATT
UNLESS OTHERWISE INDICATED

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL
E	REDRAWN & REVISED DCN 3643	12-28-60	
F	WB-1 WAS (332318-915) DCN 3990	3-23-61	
G	CHART SPEEDS WERE 1, 5, 25, 125 ; REF. NOTE REF. DCO 2449	8-18-61	
H-1 H-2	R25 WAS: 33K J-4 WAS: P-2 DCN 5335	2-17-62	
J	STARTING PT OF ARROW going TO "X" WAS FROM STATIONARY CONTACT DCN 6018	5-15-62	
J-1	ADDED DS-1 & DS-2 (LOWER RIGHT CORNER) DCN 1140	8/17/64	

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REQD	ITEM	PART NUMBER	DESCRIPTION	REMARKS	CHG
			LIST OF MATERIAL		

RD 2522 -00	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ANGLES = ± ½° .XX = ± .015 .XXX = ± .005 SURFACE = ✓ MATL. ADD FIN	DR BY DATE CH BY DATE APPR REDRAWN DCN 3643 DATE 12-28-60	NAME SCHEMATIC RD 2522-00 CODE IDENT ISSUE CODE G SCALE WT	NEXT ASSY USED ON APPLICATION BRUSH INSTRUMENTS DIVISION OF CLEVITE CORP CLEVELAND OHIO U S A DWG. NO. 430389	FIRST USE

brush

OPERATING BULLETIN

No. 65-46
April, 1965

MARK II PENMOTOR ADJUSTMENT

The Mark II penmotor, Part Number 854148-142, requires internal adjustment upon replacement of penmotor, or replacement of symmetrical clipper, Part Number 128850-3. This adjustment is required to match the above named parts, so that pen excursion is limited to 1.5 ± .5 millimeters beyond chart lines.

Perform adjustment as follows:

1. Remove power input to Recorder.

2. Adjust position of analog penmotors as follows:

   a. Adjust AXIS of penmotor trunnions to coincide with center line of chart.

   b. Adjust AXIS of penmotor trunnions to coincide with line drawn perpendicular to edge of chart paper.

   c. Install analog pens, per instruction manual. Verify the arc of pens match paper arc, and rest at center line on chart paper.

3. Adjust event pen tips to fall on a line perpendicular to the edge of the chart paper that intersects the outer printed chart line and the curved time line that the penmotor pen tips are touching. Repeat steps 2 and 3 as required.

4. Place VOLTS/CHART LINE controls to OFF position.

5. Apply power to Recorder, and place power control to ON position.

6. Depress 5 MM/SEC CHART SPEED pushbutton.

7. Center pens with PEN BIAS controls.

8. Apply a 1 cps input signal, and select sensitivity such that clipping occurs. Clipping should occur at 1.5 ± .5 millimeters beyond chart lines.

NOTE: Pen position control or 1-5 volt D.C. battery may be used as alternate signal source for step 8.

a. If clipping occurs at less than 1 millimeter beyond chart lines, remove rubber plug from top of penmotor, and turn adjustment (Figure 1) screw counterclockwise until above tolerance is met, using 3/32 allen wrench. Replace rubber plug.

b. If clipping occurs at more than 2 millimeter beyond chart edge, remove rubber plug from top of penmotor, and turn adjustment screw clockwise slowly, until required tolerance is met. Replace rubber plug.

> CAUTION: Proceed carefully with any clockwise adjustment, as too much adjustment in this direction may necessitate overhaul of penmotor.

c. If clipping does not occur, or is uneven (± 2 mm) replace symmetrical clipper 128850-3 (CR-1 in RD 2521-20, RD 2522-20, RD 2521-10, RD 2521-00; or CR-3 in RD 2522-00).

9. Recalibrate recorder per instruction manual.

NOTE: If sensitivity of penmotor is not sufficient to meet calibration requirements, overhaul is indicated. Contact your Brush Service Representative per warranty sheet in manual.

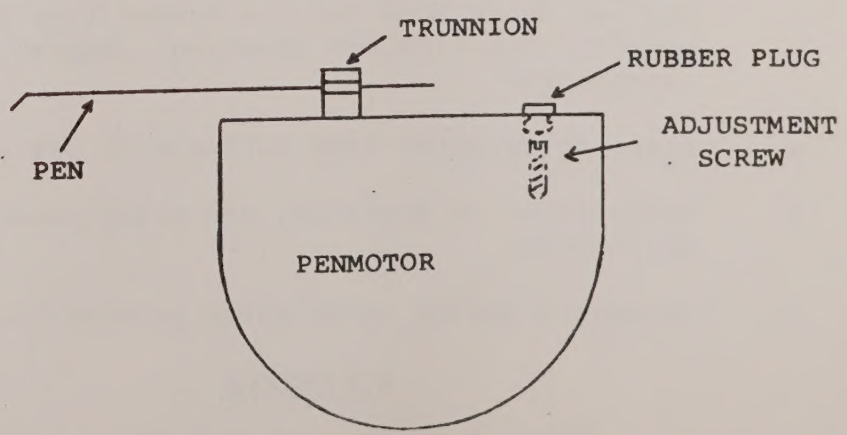

Figure 1

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CLEVITE
CORPORATION